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LG&E proposes to construct a 2340 megawatt coal-fired steam electric generating station at Wises Landing, Kentucky, Ohio River mile 571. A 1000 acre site for structural and pond facilities is needed as are two ajacent ravines (1300 acres) for solid waste disposal. Associated transmission facilities are also proposed. Major Federal actions for the project are issuance of new source NPDES Permit from EPA and a section 10/404 Construction Permit from the Army Corps of Engineers. Air Quality and scrubber technology are the major issues. Aesthetic and secondary impacts to the river valley are also significant issues.

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PB 280 931

ENVIRONMENTAL IMPACT STATEMENT

TRIMBLE COUNTY GENERATING STATION

Supporting Report

Volume I

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30308

REPRODUCED BY
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1.0 BACKGROUND

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1.0 BACKGROUND

1.1 IDENTIFICATION OF APPLICANT

Louisville Gas and Electric Company (the Applicant) distributes and sells electricity to 284,066 ultimate consumers (as of December 31, 1976) in Jefferson County and portions of Oldham, Bullitt, Meade, and Hardin Counties, and limited parts of Henry, Trimble, Shelby, and Spencer Counties, Kentucky (Figure 1.1-1). The area served covers approximately 700 square miles and contains an estimated population of 790,000, exclusive of the Fort Knox Military Reservation, which the Applicant also serves with electricity.

Geographical Distribution of Applicant's
Electric Customers as of
December 31, 1976

County	No. of Customers
Jefferson	271,475
Oldham	5,770
Bullitt	4,665
Meade	1,521
Hardin	575
Henry	46
Trimble	7
Shelby	6
Spencer	1
Total	284,066

The Applicant wholly owns one subsidiary, Ohio Valley Transmission Corporation, an Indiana corporation. This subsidiary exists to own and operate those facilities located in Indiana that are necessary to the system operations. Neither Ohio Valley Transmission Corporation nor the Applicant sells electricity directly to any ultimate consumers in Indiana.

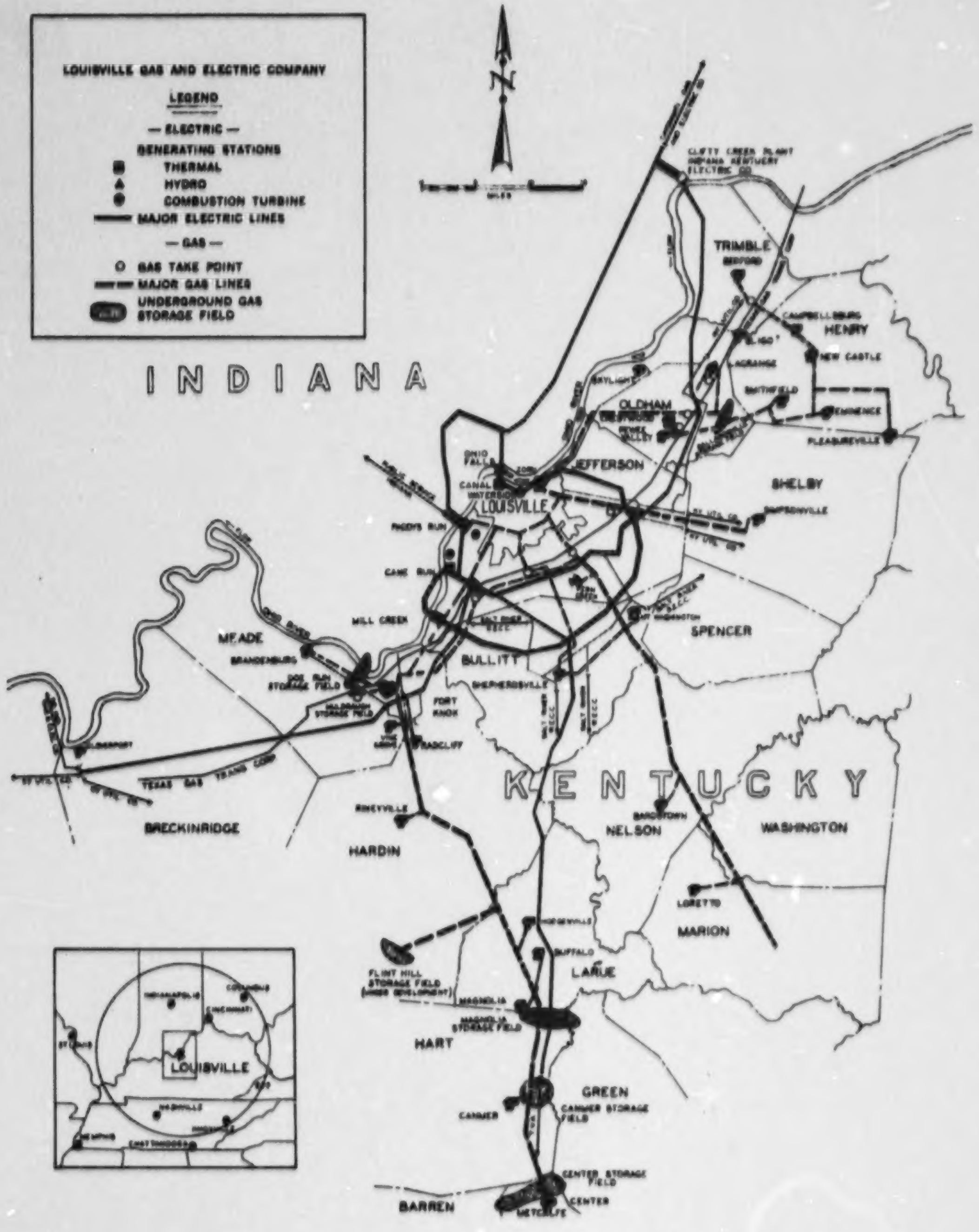
The Applicant presently has transmission interconnections and interconnection agreements with Public Service Indiana, Kentucky Utilities Company, Southern Indiana Gas & Electric Company, The Cincinnati Gas & Electric Company, Ohio Valley Electric Corporation, Tennessee Valley Authority, East Kentucky Power Cooperative, and Big Rivers Electric Corporation. These interconnections and interconnection agreements provide for various interchanges, emergency services, and other working arrangements. These interconnections, as well as those proposed, are presented in Table 1.1-1. Electric transmission interconnections and

TABLE 1.1-1

LOUISVILLE GAS AND ELECTRIC COMPANY ELECTRIC TRANSMISSION INTERCONNECTIONS

Ref. No.	Company Substation	Neighboring Utility and Connecting Substation	Line Voltage	Number of Circuits	Circuit Capacity	Status
1	Paddy's Run	PSI, Gallagher Station	138 KV	1	380 MVA	Existing
2	Paddy's Run	TVA, Summershade	161 KV	2	120 MVA each	Existing
3	Cloverport	SIGE, Newtonville	138 KV	1	160 MVA	Existing
4	Cloverport	KU, Owensboro	138 KV	1	280 MVA	Existing
5	Cloverport	KU, Hardinsburg	138 KV	1	215 MVA	Existing
6	Middletown	KU, Finchville	69 KV	2	36 MVA each	Existing
7	Eastwood	KU, Shelbyville	69 KV	1	36 MVA	Existing
8	Cloverport	BR, Hardinsburg	138 KV	1	215 MVA	Existing
9	Middletown	OVEC, Clifty Creek	345 KV	1	1,200 MVA	Existing
10	Northside	OVEC, Clifty Creek and CG&E, Miami Fort	138 KV	1	100 MVA	Scheduled June 1977
11	Northside	PSI, Jeffersonville	138 KV	1	478 MVA	Scheduled June 1977
12	Beargrass	PSI, Jeffersonville	138 KV	1	478 MVA	Scheduled June 1977
13	Northside	PSI, Speed	138 KV	1	478 MVA	Scheduled June 1977
14	Northside	PSI, Speed	345 KV	1	1,200 MVA	Conceptual
15	Bluelick	KU, Elizabethtown	345 KV	1	1,200 MVA	Conceptual
16	Trimble County	PSI, Marble Hill	345 KV	1	1,200 MVA	Conceptual
17	Trimble County	KU, Ghent	345 KV	1	1,200 MVA	Conceptual

Source: Louisville Gas and Electric Company, 1977


LOUISVILLE GAS AND ELECTRIC COMPANY
LEGEND
— ELECTRIC —
GENERATING STATIONS
■ THERMAL
▲ HYDRO
● COMBUSTION TURBINE
MAJOR ELECTRIC LINES
— GAS —
○ GAS TAKE POINT
MAJOR GAS LINES
UNDERGROUND GAS STORAGE FIELD
N
MILES
INDIANA
KENTUCKY
CLIFTY CREEK PLANT
INDIANA KENTUCKY ELECTRIC CO.
TRIMBLE
BEDFORD
CAMPBELLSBURG
HENRY
NEW CASTLE
LAGRANGE
SKYLIGHT
OLDHAM
SMITHFIELD
EMINENCE
PLEASUREVILLE
OHIO FALLS
CANAL
WATERSIDE
LOUISVILLE
JEFFERSON
SHELBY
SHELBYVILLE
PADDYS RUN
CANE RUN
MILL CREEK
SPENCER
MEADE
BRANDENBURG
DOE RUN STORAGE FIELD
MULDRAUGH STORAGE FIELD
BULLITT
SHEPHERDSVILLE
FORT KNOX
RADCLIFF
TEXAS GAS TRANS CORP
BRECKINRIDGE
RINEYVILLE
HARDIN
BARDSTOWN
NELSON
WASHINGTON
LORETTO
MARION
HODGENVILLE
BUFFALO
LARUE
FLINT HILL STORAGE FIELD (UNDER DEVELOPMENT)
MAGNOLIA
MAGNOLIA STORAGE FIELD
HART
GREEN
CANMER
CANMER STORAGE FIELD
CENTER STORAGE FIELD
CENTER
BARREN
METCALFE
INDIANAPOLIS
COLUMBUS
CINCINNATI
ST. LOUIS
LOUISVILLE
NASHVILLE
KNOXVILLE
MEMPHIS
CHATTANOOGA

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

SYSTEM MAP

FIGURE 1.1-1

coordination of operations among the interconnected utilities serve to reduce the amount of installed generating reserves (see Section 1.3.3) which the Applicant would otherwise have to install in its own system to maintain a reliable supply of electric power to its customers under creditable contingency conditions. Power is normally exchanged via these interconnections for emergency, maintenance, or economy purposes on an "as-available" basis.

The Applicant is a party to the East Central Area Reliability Coordination Agreement (ECAR) along with 26 other major bulk power suppliers in eight east-central states. The service areas of these suppliers are shown in Figure 1.1-2. There are nine such regional groups (shown in Figure 1.1-3). The National Electric Reliability Council (NERC), founded in 1968, provides the coordination of these regional groups.

As of December 1976, the net seasonal summer generation capability of the Applicant's system is 2,139 MWe (Table 1.1-2). The bulk of this capacity is coal-fired, although it does include six combustion turbine units and eight run-of-the-river hydroelectric units. All units are loaded incrementally on an economic basis. This means that the newer, more efficient units are operated in the base load mode, while the smaller, less efficient units are operated in the medium range and peaking mode.

The Applicant has two new units with capacities of 425 MWe and 495 MWe under construction at the Mill Creek plant. These are scheduled for operation in December 1977 and June 1980, respectively. The new Mill Creek units, and other units planned through 1990, are described in Table 1.1-3.

Several older units will be retired, as shown in Table 1.1-4. These units are scheduled to be retired because they will be obsolete, relatively inefficient to operate, costly to maintain, and difficult to retrofit with equipment that is required to comply with environmental regulations.

TABLE 1.1-2

LOUISVILLE GAS AND ELECTRIC COMPANY
PRESENT GENERATING CAPACITY

Station and Unit Number	In Service Date	Type	Net Seasonal Summer Capability in KWe[a]
CANE RUN #1	1954	Steam-Coal	110,000
#2	1956	Steam-Coal	107,000
#3	1958	Steam-Coal	137,000
#4	1962	Steam-Coal	174,000
#5	1966	Steam-Coal	183,000
#6	1969	Steam-Coal	277,000
			988,000
CT #11	1968	Combustion Turbine	16,000
		TOTAL	1,004,000
MILL CREEK #1	1972	Steam-Coal	334,000
#2	1974	Steam-Coal	325,000
		TOTAL	659,000
PADDY'S RUN #1	1942	Steam-Coal	29,000
#2	1942	Steam-Coal	28,000
#3	1947	Steam-Coal	63,000
#4	1949	Steam-Coal	65,000
#5	1950	Steam-Coal	70,000
#6	1952	Steam-Coal	67,000
			322,000
CT #11	1968	Combustion Turbine	17,000
CT #12	1968	Combustion Turbine	26,000
			43,000
		TOTAL	365,000
WATERSIDE #7	1964	Combustion Turbine	17,000
#8	1974	Combustion Turbine	18,000
		TOTAL	35,000
ZORN CT #11	1969	Combustion Turbine	15,000
OHIO FALLS - 8 units	1928	Run-of-River Hydrostation	61,000
	Total System Steam		1,969,000
	Total System Combustion Turbine		109,000
	Total System Hydro		61,000
		TOTAL	2,139,000

---

[a] Data from latest East Central Area Reliability Coordination Agreement uniform rating documents.

Source: Louisville Gas and Electric Company, January 1977.

TABLE 1.1-3

LOUISVILLE GAS AND ELECTRIC COMPANY
GENERATION RESOURCE ADDITIONS
1976-1990

Station and Unit Member	Operating Date	Type	Net Capacity of Unit in KWe
MILL CREEK #3	Scheduled Dec. 1977	Steam-Coal	425,000
#4	Scheduled June 1980	Steam-Coal	495,000
	Total Addition		920,000
TRIMBLE COUNTY #1	Planned June 1983	Steam-Coal	495,000
#2	Planned June 1985	Steam-Coal	495,000
#3	Planned June 1987	Steam-Coal	675,000
#4	Planned June 1989	Steam-Coal	675,000
	Total Addition		2,340,000
UNDESIGNATED	Planned June 1984	Combustion Turbine	65,000
	Total Resource Addition		3,325,000

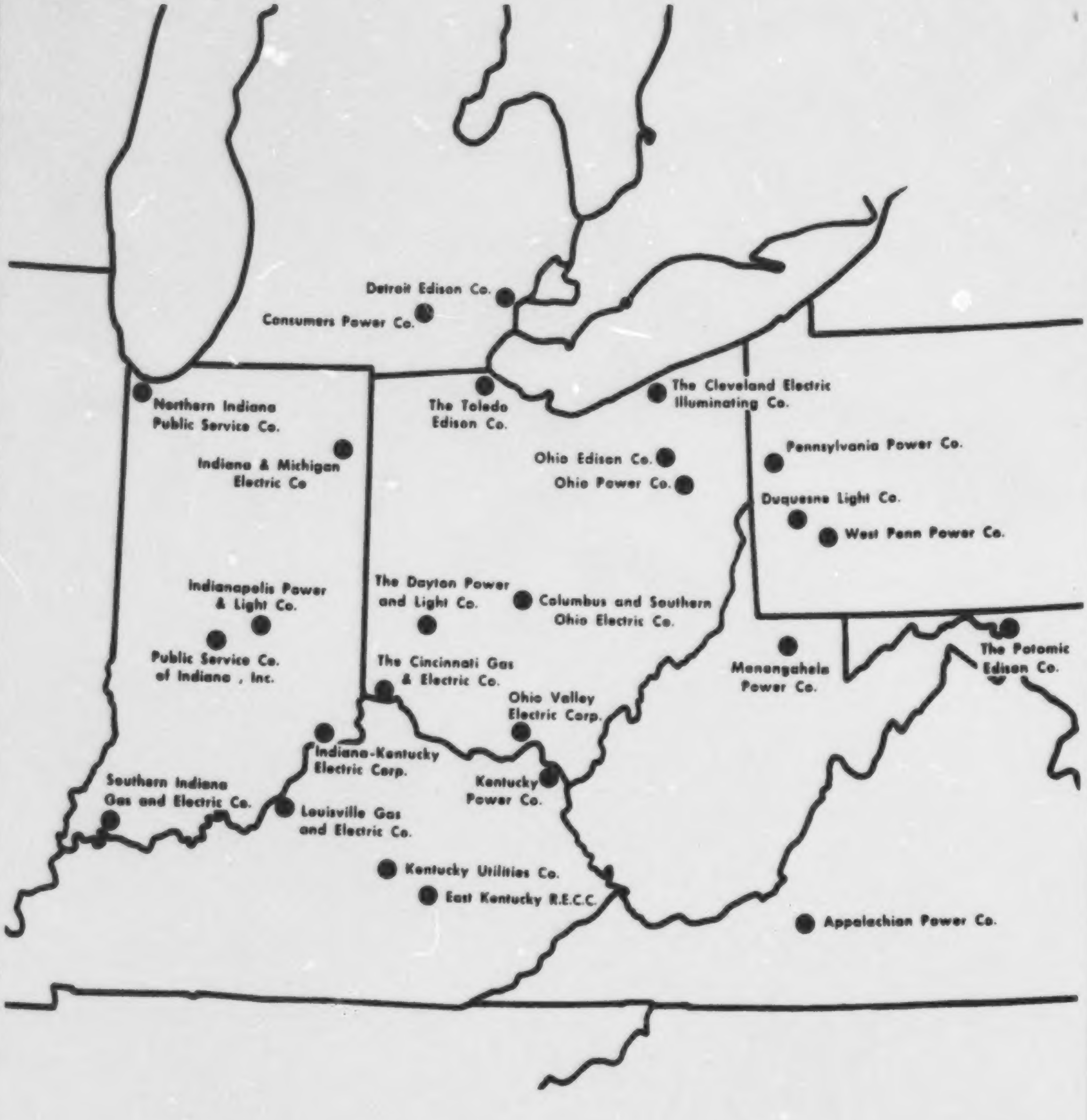
Source: Louisville Gas and Electric Company, January 1977

TABLE 1.1-4

LOUISVILLE GAS AND ELECTRIC COMPANY
GENERATING STATION RETIREMENT PLANS
1977-1990

Station and Unit Number		Planned Retirement Date	Type	Net Capacity of Unit in KWe
Paddy's Run	#1	June 1979	Steam-Coal	29,000
	#2	June 1979	Steam-Coal	28,000
	#3	June 1981	Steam-Coal	63,000
	#4	June 1981	Steam-Coal	65,000
	#5	June 1983	Steam-Coal	70,000
	#6	June 1984	Steam-Coal	67,000
Cane Run	#1	June 1985	Steam-Coal	110,000
	#2	June 1985	Steam-Coal	107,000
	#3	June 1987	Steam-Coal	137,000

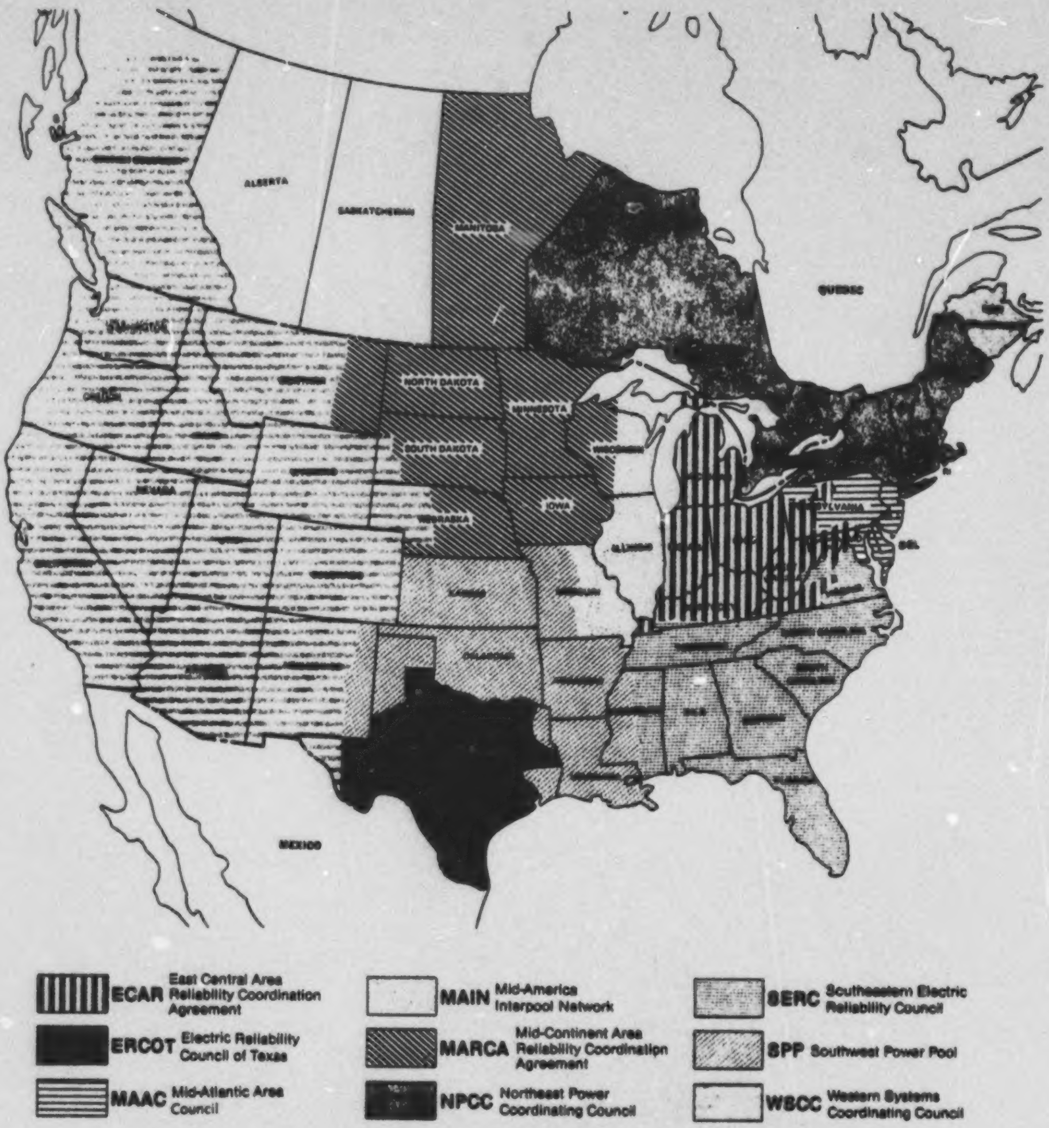
Source: Louisville Gas and Electric Company, January 1977.


Detroit Edison Co.
Consumers Power Co.
Northern Indiana Public Service Co.
The Toledo Edison Co.
The Cleveland Electric Illuminating Co.
Indiana & Michigan Electric Co
Ohio Edison Co.
Ohio Power Co.
Pennsylvania Power Co.
Duquesne Light Co.
West Penn Power Co.
Indianapolis Power & Light Co.
The Dayton Power and Light Co.
Columbus and Southern Ohio Electric Co.
Public Service Co. of Indiana, Inc.
The Cincinnati Gas & Electric Co.
Monongahela Power Co.
The Potomic Edison Co.
Ohio Valley Electric Corp.
Indiana-Kentucky Electric Corp.
Southern Indiana Gas and Electric Co.
Kentucky Power Co.
Louisville Gas and Electric Co.
Kentucky Utilities Co.
East Kentucky R.E.C.C.
Appalachian Power Co.

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

MEMBER COMPANIES OF THE
EAST CENTRAL AREA RELIABILITY
COORDINATION AGREEMENT

FIGURE 1.1-2


ALBERTA
SASKATCHEWAN
MANITOBA
QUEBEC
NORTH DAKOTA
MINNESOTA
SOUTH DAKOTA
WISCONSIN
IOWA
NEBRASKA
NEVADA
ILLINOIS
PENNSYLVANIA
DEL
MEXICO
ECAR East Central Area Reliability Coordination Agreement
ERCOT Electric Reliability Council of Texas
MAAC Mid-Atlantic Area Council
MAIN Mid-America Interpool Network
MARCA Mid-Continent Area Reliability Coordination Agreement
NPCC Northeast Power Coordinating Council
SERC Southeastern Electric Reliability Council
SPP Southwest Power Pool
WSCC Western Systems Coordinating Council

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NATIONAL ELECTRIC RELIABILITY COUNCIL

FIGURE 1.1-3

1.2 PROJECT OBJECTIVES

The objective and obligation of a power company, or any public service organization, is to provide service within the company's service area to anyone who requests it. Adequacy of service is another obligation. While a public utility cannot provide service beyond its capacity, it is nonetheless obligated to provide the amount of service demanded by its customers (load), and to expand its facilities, insofar as this is feasible, to satisfy this demand.

To fulfill these basic obligations, an electric power company must anticipate the future power requirements of its customers and make a commitment for providing the necessary generating capacity well in advance of the time when consumers first make decisions (to install air conditioning, to buy a second TV) that increase their power requirements. These needs must be anticipated and commitments made far in advance because the lead time for developing a single generating unit is long (5 to 7 years). Shortages of materials, delays in equipment deliveries, additional licensing requirements imposed by regulatory agencies, environmental studies and report processing are some of the factors for which time must be allowed.

In addition to providing electric power in amounts that meet the requirements of its customers, and to anticipating their future needs and the consequent need for upgrading or expansion of its facilities, an electric power company must maintain the highest practicable efficiency in providing its services. Among other things, this means that new installations must not be built if the company judges that additional generating capacity will not be required. The economic penalties to both consumer and stockholder of carrying the fixed charges of unnecessary generating capacity are in themselves a deterrent to overexpansion.

The Applicant has carefully evaluated the future requirements of its customers on the basis of the historical growth rates and load forecasting methodology discussed in Section 1.3. From this, the Applicant has concluded that the net total electric demand of its customers can reasonably be expected to increase from 1,707 MW (the adjusted load during the summer of 1976) to 2,482 MW by 1983 and 3,543 MW by 1990. In order to meet this future load growth and to maintain adequate generation reserves (discussed in Section 1.3) for reliable service, the Applicant has determined that it is necessary to add to its system a new generating facility to begin service in 1983. (A discussion of the various alternatives to new plant construction is presented in Section 3.0.) To this end, the Applicant has proposed to construct a 2,340-MWe generating plant (described in Section 4.0) near Wises Landing in Trimble County, Kentucky.

1.3 RESERVE CAPACITY

To ensure the ability of a system to meet its obligations reliably, a component of capacity referred to as installed reserve capacity, which is in excess of the expected load demand, must be installed in each system. This installed reserve capacity component is a function of the combined probabilities of: (1) unscheduled forced outage of generation (i.e., equipment not available for service on any given day for reasons other than controllable, prescheduled maintenance); (2) derating of equipment due to such causes as equipment wear, high cooling water temperatures, boiler condition, auxiliary equipment outages, wet coal, etc.; (3) sudden forced outage of generation in service (i.e., forced outage of a major block of generation in service on either the owner's or an interconnected company's system); and (4) deviation from the long-range forecast due both to inherent limitations in accuracy and to actual temperatures greater than the base temperature on which the forecast was predicated. In addition, the installed reserve capacity is a function of a component referred to as daily operating or spinning reserve (described in Appendix A).

Operating criteria developed for interconnected systems operation require the Applicant to have in service, or available for quick start at all times, generation in excess of its expected peak load for the day. This excess generation must be a minimum of approximately 6 percent of such peak load in order to: (1) maintain stable operating conditions within the area in the event of the sudden loss of generation at any place within the interconnected systems' area; (2) provide for load regulation (balance between gross generator output and the total of customer loads, system losses, station auxiliary power, and other company uses) from minute to minute; and (3) maintain system frequency regulation (see Appendix A). These criteria were developed collectively by the member companies of the East Central Area Reliability Coordination Agreement and have been approved by the East Central Area Reliability Coordination Agreement's Executive Board.

The Applicant bases its load forecast on the probability of an occurrence of an 86°F mean daily temperature which is expected to be experienced in 50 percent of the summer seasons (this is discussed in greater detail in Section 1.4). By definition, higher temperatures than this can be expected to occur in 50 percent of the years. In the Applicant's service area, a 90°F mean daily temperature occurs with a frequency of 1 out of 10 years. Should a mean temperature of 90°F be experienced, the actual load that the Applicant would experience is expected to exceed the forecasted median load by about 5 percent. Further, the inherent inaccuracies in forecasting techniques and factors affecting load that are beyond the control of the Applicant and are not subject to prediction can result in daily deviations from the forecast on the order of plus or minus 10 percent.

While the aforementioned contingencies arithmetically add to substantially more than 20 percent, the Applicant has based its capacity planning on the maintenance of a minimum of 20 percent of its forecasted median 86°F mean daily temperature load expectancy. By operating in a coordinated interconnected system with established strong transmission interconnections to its neighboring utilities, the risk of coincident adversities is sufficiently reduced to sustain an appropriate level of reliability with planning based on this minimum level of reserves (assuming average reserves will somewhat exceed this amount). This level of reserves is not materially inconsistent with planning practices elsewhere in the industry, including those systems or regions that plan on the basis of probability of loss of load or similar probability analyses.

In addition to the previously described components that determine the amount of reserve capacity required to be installed in any system, there are other factors that determine the amount of reserves the Applicant is required to maintain, which in turn determine the Applicant's future need for increased power generation capacity.

The Applicant is a participating (7-percent) owner with 14 other electric utilities in the Ohio Valley Electric Corporation (OVEC). This involvement carries an entitlement to receive and an obligation to pay for any excess capacity that OVEC generates that is not needed to supply the requirements of Energy Research and Development Agency's (ERDA) nuclear enrichment plant, which is the sole customer of OVEC. Conversely, if OVEC's capacity is insufficient to supply the ERDA plant, the Applicant has an obligation to supply a portion of the deficit. In 1975, the Applicant's capacity requirements were reduced approximately 45 MWe because of the excess capacity available from OVEC. However, beginning in 1976, the Applicant had a net obligation to supply capacity to OVEC due to projected increases in the ERDA plant's energy requirements. This net obligation, expected to be 51 MW by 1980, is included in the Applicant's overall generation requirement.

Further, while each East Central Area Reliability Coordination Agreement company is responsible for determining the generation reserve level which is appropriate for its system, East Central Area Reliability Coordination Agreement reviews these plans to determine the overall adequacy of the generating reserves planned for the area under its jurisdiction. In general, the Applicant's minimum 20-percent reserve capacity criterion has been considered appropriate to satisfy the East Central Area Reliability Coordination Agreement objectives. The trend toward larger and more complex generation equipment, delays in construction, greater uncertainties in load forecast, reduction in the differential between winter and summer peak loads, and the increasing dependence of essential customer requirements (heating, cooking) upon reliable electric service (see Section 1.4) could dictate even higher reserve levels in the future.

The most significant constraint on the Applicant to install new generation capacity in its system is indicated by Table 1.3-1. Without the Trimble County addition, the Applicant's reserve level would drop to 9 percent in 1983; by 1985, the Applicant would be in the untenable position of not being able to carry its load, even if all the capacity were fully available at the time of the peak. Other constraints resulting in the decision to install new generation capacity in the form of a new plant are detailed in Sections 3.1 and 3.2.

TABLE 1.3-1

LOUISVILLE GAS AND ELECTRIC COMPANY PROJECTED SYSTEM LOADS AND CAPACITIES, 1976-1990
(Note: Parentheses indicate negative numbers)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Peak Load (MWe)[a]	1707[b]	1778	1862	1975	2091	2211	2344	2482	2624	2768	2915	3065	3221	3381	3543
Capacity Changes															
Steam		425[c]			495			495		495		675		675	
Combustion Turbine									65						
Hydro															
Rerating	(4)		(8)[d]	(13)[d]		(15)[d]	(15)[d]								
Retirements				(57)[e]		(128)[f]		(70)[g]	(67)[h]	(217)[i]		(137)[j]			
Firm Purchases (Sales)[k]	(55)		(11)	(13)	(17)										
Total Capacities															
Steam	1969	1969	2386	2316	2811	2668	2653	3078	3011	3289	3289	3827	3827	4502	4502
Combustion Turbine	109	109	109	109	109	109	109	109	174	174	174	174	174	174	174
Hydro	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Firm Purchases (Sales)[c]	(10)	(10)	(21)	(34)	(51)	(51)	(51)	(51)	(51)	(51)	(51)	(51)	(51)	(51)	(51)
TOTAL (MWe)	2129	2129	2535	2452	2930	2787	2772	3197	3195	3473	3473	4011	4011	4686	4686
Reserve - With Trimble County															
Capacity	422	351	673	477	839	576	428	715	571	705	558	946	790	1305	1143
Percent of Peak Load	25	20	36	24	40	26	18	29	22	25	19	31	24	38	32
Reserve - Without Trimble County															
Capacity	422	351	673	477	839	576	428	270	76	(285)					
Percent of Peak Load	25	20	36	24	40	26	18	9	3	(10)					

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[a] Median summer forecast.

[b] Adjusted for temperature and known curtailments.

[c] December 1977 operating date--not available for 1977 summer peak.

[d] Deratings due to sulfur dioxide removal systems.

[e] Retirement Paddy's Run #1 and #2.

[f] Retirement Paddy's Run #3 and #4.

[g] Retirement Paddy's Run #5.

[h] Retirement Paddy's Run #6.

[i] Retirement Cane Run #1 and #[illegible].

[j] Retirement Cane Run #3.

[k] Ohio Valley Electric Corporation (OVEC) sales or purchases.

1.4 ELECTRICAL DEMAND FORECAST METHODOLOGY EMPLOYED BY THE APPLICANT

1.4.1 Introduction

If all the factors affecting historic peak demand (load) growth were constant throughout a period under study and could be counted on to remain constant in the future, then it would be axiomatic that loads would have grown uniformly through the historical period. This historical growth could then be projected to continue at the same rate.

In the not too distant past, this appeared to be a reasonable assumption; load growth generally came about from more or less natural and recurring causes. There were some deviations from year to year with varying economic and weather conditions, but these variations usually were both above and below a relatively constant growth curve. When this historical growth pattern was interrupted in the mid-1960s by the introduction of significant air conditioning loads, summer peak demands began increasing at a somewhat consistent but nevertheless new rate.

More recently, there is evidence that a new set of socioeconomic factors and controls may influence historical growth rates. These new factors may include imposed economic controls, responses to conservation efforts, and price or rate structure influences on energy consumption.

Factors as yet undefined will continue to determine energy demand in the future. Therefore, consideration of historical growth patterns is of only partial value. However, analysis of historical trends can enable the planner to judge how anticipated socio-political-economic factors will influence the otherwise natural load growth trends in the future.

1.4.2 Factors that Affect System Demand

The reserve margin that a utility must maintain (see Section 1.3) is based, among other considerations, on the average peak demand that the system has a 50 percent probability of experiencing one or more times during any year (called the 50 percent potential average peak). This probability is a function of many things, among which are the following:

1. Coincidence of individual customer demands within classes (i.e., residential)

2. Coincidence of demands among classes (i.e., large industrial and residential)

3. Industrial vacations and shutdowns

4. Economic and social activity (as it varies from day to day as opposed to year to year) and the day's relationship to holidays and weekends and heavy or light vacation periods

5. Weather-related factors, including temperature, relative humidity, percent sunlight, temperature profile over the day, and peak temperature profile for several days immediately preceding the day under study

These factors can be combined into two general categories for use in long-range planning. The first of these categories is weather, with the mean summer temperature (defined from historical data to be 86°F) considered an independent variable that is representative, on the average, of all weather variables. The second general category is the combined effect of all other factors, exclusive of weather.

Conservation efforts also have some effect on system demand. The Applicant has undertaken, and expects to continue, extensive public educational efforts to promote and encourage the conservation of energy, particularly electricity and gas. Media used for information and communication have included the following:

1. Bill inserts
2. Presentations to civic groups
3. Support materials and speakers for school curricula
4. Company-sponsored industry programs
5. Direct contact (meetings, interviews) with selected major customers
6. Newspaper and radio advertising

Effects of anticipated conservation efforts by the Applicant's customers and the effect of the cost of electric energy on load growth were taken into consideration in the estimates of future demands presented in this report.

Generally, while it is expected that higher rates for electricity will create further conservation incentives, particularly on the part of residential customers, the current shortage of oil and gas and the stated national goal of energy independence will also result in an increased dependence on electric energy. Electricity usage can be expected to increase as existing oil- or gas-using processes are converted to electric, as electric devices are applied in new expansions that would historically have used gas, and as electricity is used for new space heating requirements.

Some of the increased electricity demand, however, will be offset by technological improvements in electric appliance efficiency--particularly in new and replacement air conditioning installations, which are expected to require less power per unit of cooling capacity than the average installation now on the Applicant's system. Consequently, while net annual energy consumption is expected to increase in the service area, the increases will be at a lower rate than if conservation elements were not at work.

1.4.3 Demand Analysis Methodology

In analyzing historical load in order to compare it to a forecast made for a particular year or for forecasting future load, one mistake is commonly made. This mistake consists of selecting the one day's load (out of 60 days, more or less, during the peak load season) that was recorded as the highest load carried during a summer, and accepting this load as representative of the potential peak for the year. Chances are infinitesimal that the day selected was both an 86° day and a day on which all other factors had precisely their average influence, which combination of factors is what the utility is attempting to forecast.

The Applicant's method of analyzing historical data is to plot the peak load actually experienced on each weekday of the summer season (adjusted, where appropriate, for large industrial customers whose load was known to be abnormally curtailed on that day) as a function of the actual mean temperature for that day. By projecting the average load versus temperature line to its intercept with 86°, the planner can estimate the potential average peak load that the system should have been capable of handling without infringing on its design reserve requirements. From this, he can then begin to estimate the peak demand that the system must be prepared to meet in the following years.

Composition of the Applicant's Internal Generating Load

For the purpose of forecasting, the Applicant has considered its total internal load as consisting of four major categories:

1. A major industrial component
2. A temperature-sensitive component
3. An industrial gas conversion component
   (a component not present in the historical data)
4. All other load

These components are described in the following paragraphs.

Major Industrial Component

This component consists, as the name suggests, of the energy demand of large industrial customers in the Applicant's service area. Roughly 50 percent of this load is accounted for by four large customers: Airco, General Electric, du Pont, and International Harvester. The percent of electric sales (relative to total internal sales) to the large industrial component from 1964 to 1974, and projected for the years 1983, 1989, and 1990, is included in Table 1.4.3-1.

Temperature-Sensitive Component

Around the mid-1960s, the use of residential air conditioning began having a significant influence on utility generating loads, making forecasts based on historical peak loads no longer accurate. It became necessary to attempt to identify the effect of temperature on peak load and to adjust forecasts to reflect this factor. By the late 1960s, air conditioning load growth had settled into a pattern that remained reasonably predictable until the last 2 years.

There are two basic parameters that influence forecasts of the temperature-sensitive component. The first has to do with the growth in the total number of residential customers. The second parameter has to do with the number of present customers who install air conditioners. Personal income and climate are the two most dominant factors affecting the marketing of air conditioners in a given area; the Applicant believes it is reasonable to expect that approximately 80 percent of its total electric customers will eventually install air conditioning equipment. At present, 65 percent of the Applicant's customers have cooling equipment. The 80-percent saturation level is expected to be reached in the early 1990s. From that point on, temperature-sensitive growth will result only from the addition of new residential customers.

Industrial Gas Conversion Component

A factor not present in historical peak demand data is the present conversion by industries from gas to electric energy as a result of the curtailment of natural gas for heavy industrial uses. Approximately 10 percent (60 MW) of the existing gas-fired industrial equipment within its service area is presently projected by the Applicant to be converted to electrical heating equipment. This is believed by the Applicant to be a conservative estimate, as one large industrial customer has already indicated that he alone is considering the conversion of about 100 MW of equipment.

Other Load Component

This component is referred to as the non-industrial base load at 70°F. However, it includes certain light industrial and commercial load not accounted for in the data base for the major industrial component. It also contains that portion of the air conditioning load (temperature-sensitive component) that occurs below a mean temperature of 70°F. Columns 2 through 5 in Table 1.4.3-1 present the percent of sales to this component of the Applicant's system.

Method Employed to Establish Historical Demand for the Four Components

Actual historical load data for the peak load season (summer) of the years 1965 through 1976 were analyzed to establish, for each of those years, the average potential peak load at 86°F (the design temperature). To establish the average potential peak load at 86°F, each weekday load during the peak load season in which the mean temperature for the day was 70°F or higher was plotted (Figures 1.4.3-1, -2, -3, -4, and -5). A least-squares technique was then employed to develop a straight line through the points. This line represents the average expected load. When this line is projected to 86°, the result is the average potential peak demand that the system would actually have experienced on the day when the mean temperature was 86°F. These average potential peaks became the basis for the forecasting of future capacity requirements.

TABLE 1.4.3-1

LOUISVILLE GAS AND ELECTRIC COMPANY PERCENT ELECTRIC SALES BY CLASSES OF ULTIMATE CONSUMERS 1964-1990

Year	Large Industrial (%)	Residential (%)	Large Commercial (%)	Small Commercial and Industrial (%)	Public Authorities (%)
1964	54.42	19.74	8.78	8.46	8.60
1965	54.74	19.81	8.77	8.29	8.39
1966	54.20	20.50	8.95	8.01	8.34
1967	52.18	21.21	9.81	8.05	8.75
1968	51.03	22.42	10.22	7.91	8.42
1969	48.74	24.05	10.60	8.02	8.59
1970	46.74	25.08	11.06	8.21	8.91
1971	45.41	25.71	11.40	8.31	9.17
1972	45.01	25.81	11.44	8.65	9.09
1973	42.55	27.21	12.45	8.81	8.98
1974	42.71	26.79	12.83	8.99	8.68
1983	33.7	33.4	15.6	8.6	8.7
1989[a]	28.8	35.5	17.3	7.7	10.7
1990	28.2	35.9	17.6	7.6	10.7

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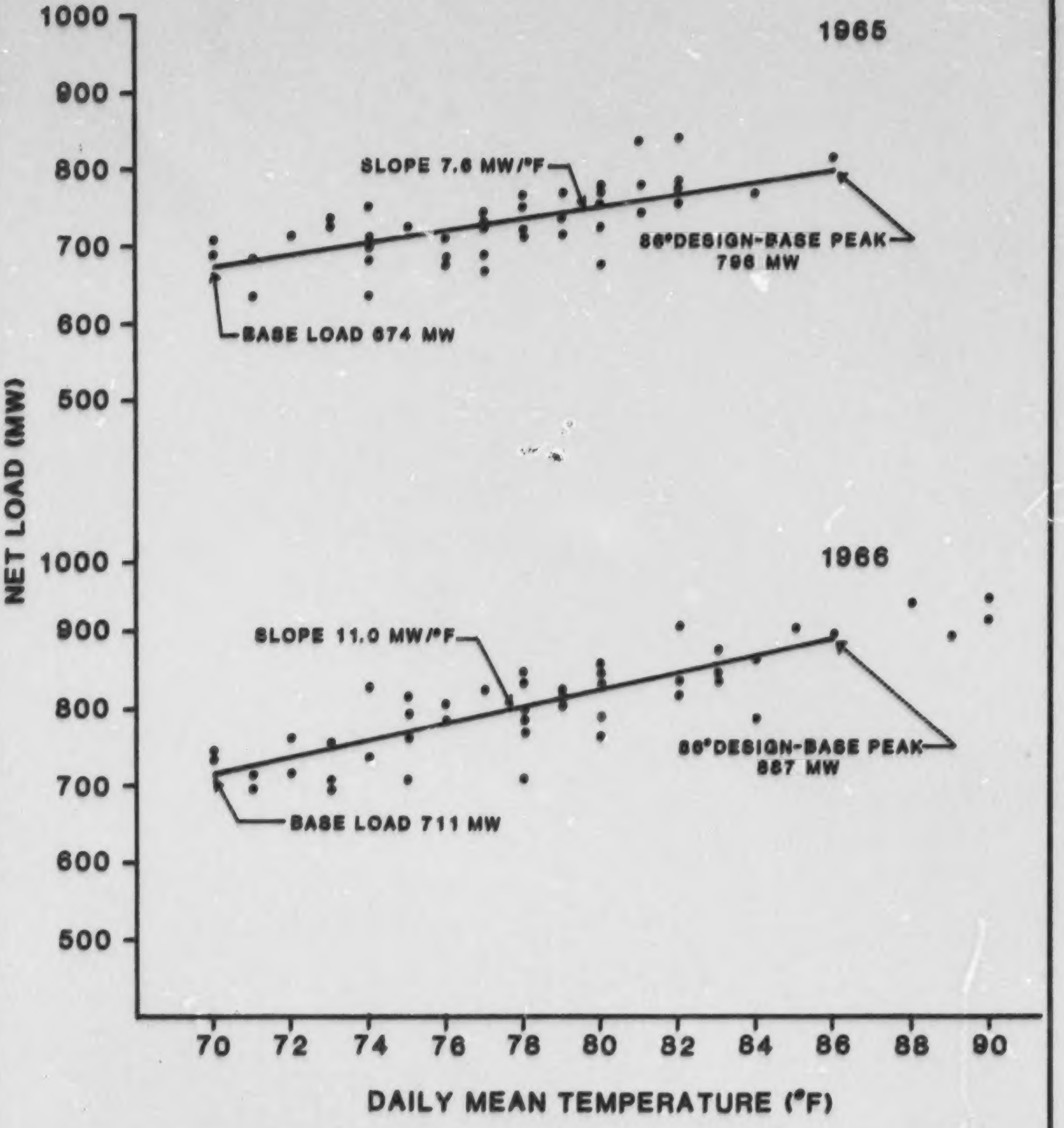
[a] Projected for first year that all four units of the proposed generating plant are in operation.

The temperature-sensitive component for each of the above years (derived from the concurrent analysis of the actual load value) was then subtracted from the total load to establish the average industrial plus non-industrial base load at 70°F. Historical data were then used to estimate the major industrial component for each year. The average non-industrial base load at 70°F is then, by definition, that which remains after subtraction of the temperature-sensitive and the major industrial components from the 86°F design-base peak.

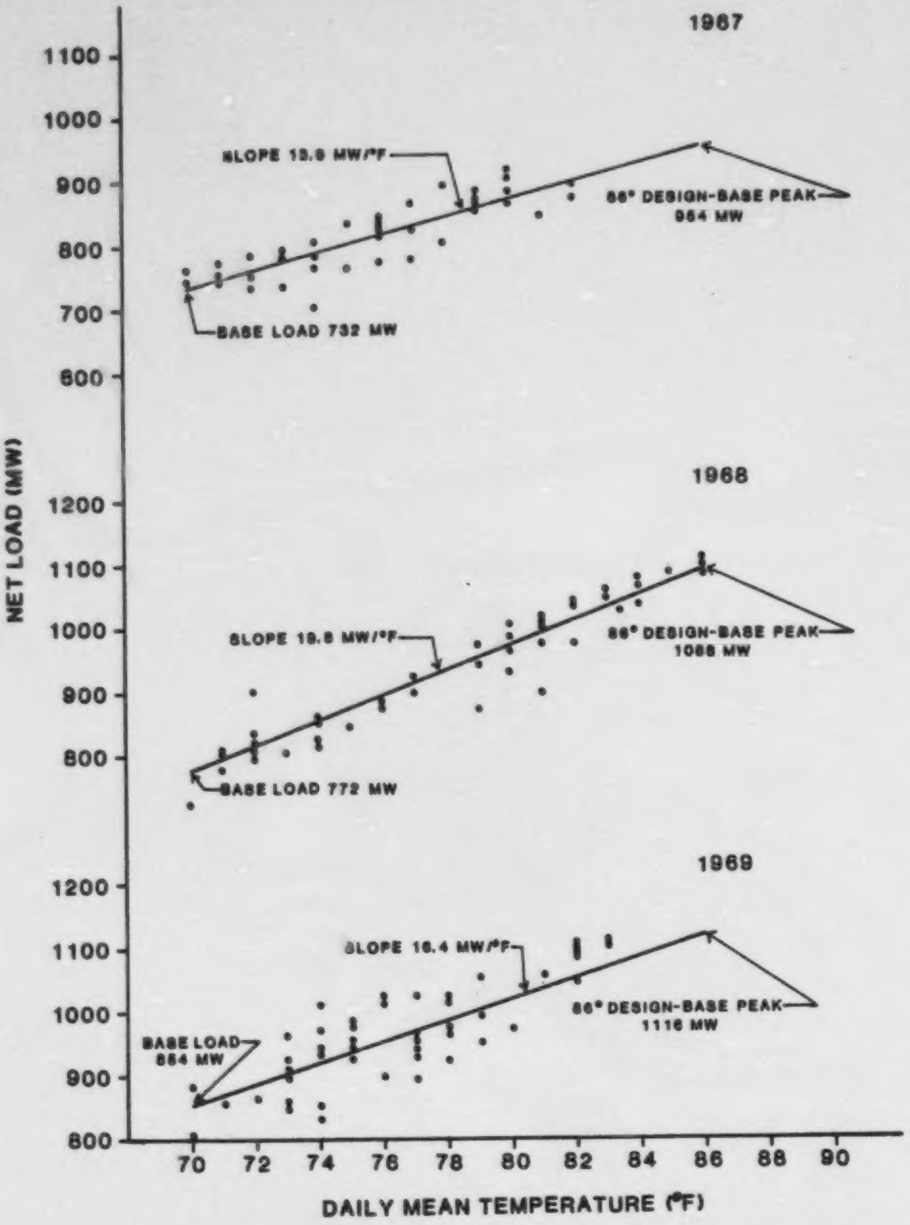


LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NET ELECTRICAL LOAD VS.
MEAN TEMPERATURE
1965 AND 1966

FIGURE 1.4.3-1

NOTE:
LOAD ADJUSTED FOR
INDUSTRIAL VACATIONS

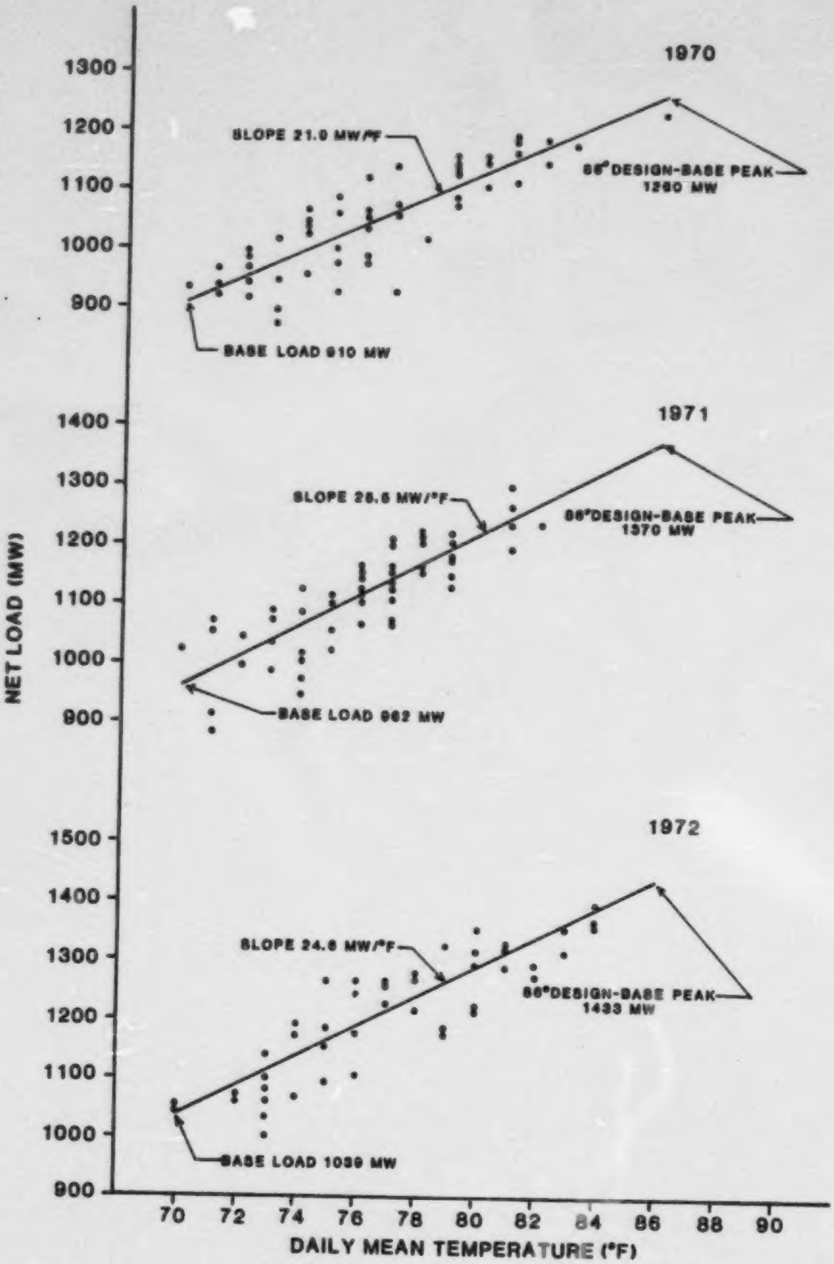


LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NET ELECTRICAL LOAD VS.
MEAN TEMPERATURE
1967, 1968, AND 1969

FIGURE 1.4.3-2

NOTE:
LOAD ADJUSTED FOR
INDUSTRIAL VACATIONS.

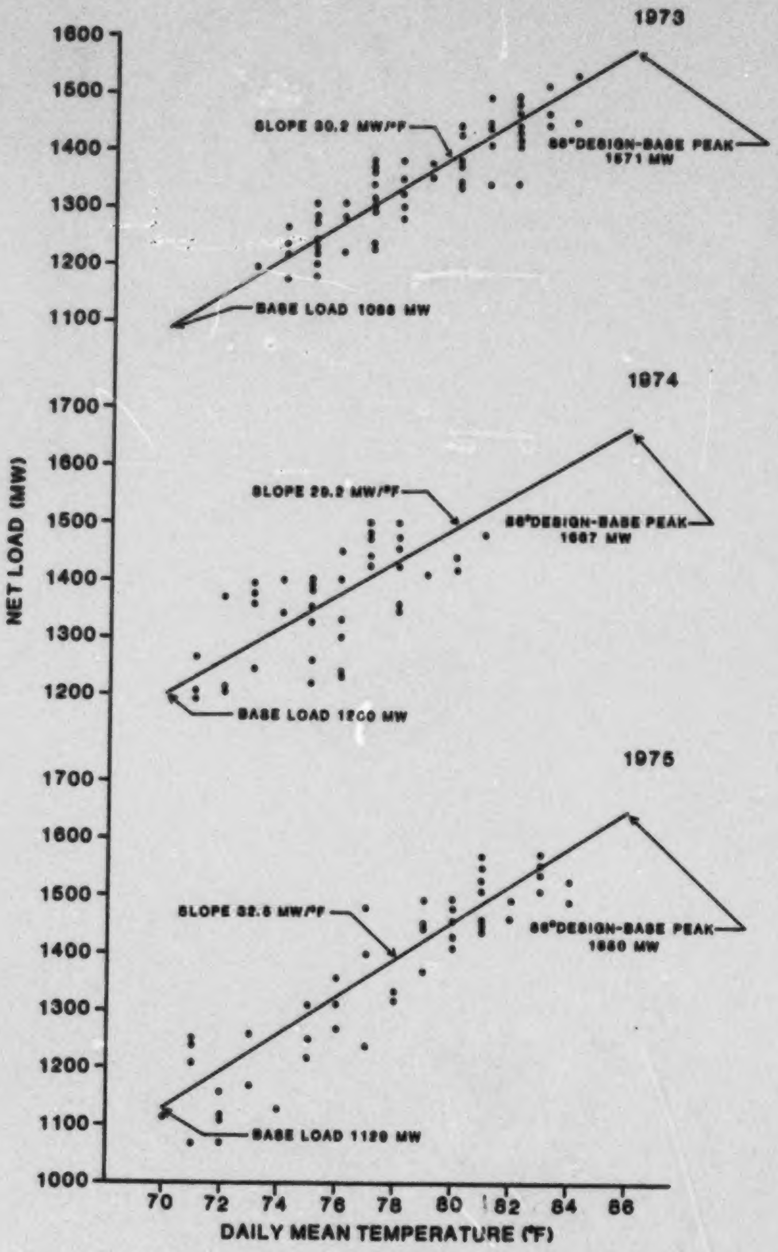


NOTE:
LOAD ADJUSTED FOR INDUSTRIAL VACATIONS

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NET ELECTRICAL LOAD VS.
MEAN TEMPERATURE
1970, 1971, AND 1972

FIGURE 1.4.3-3

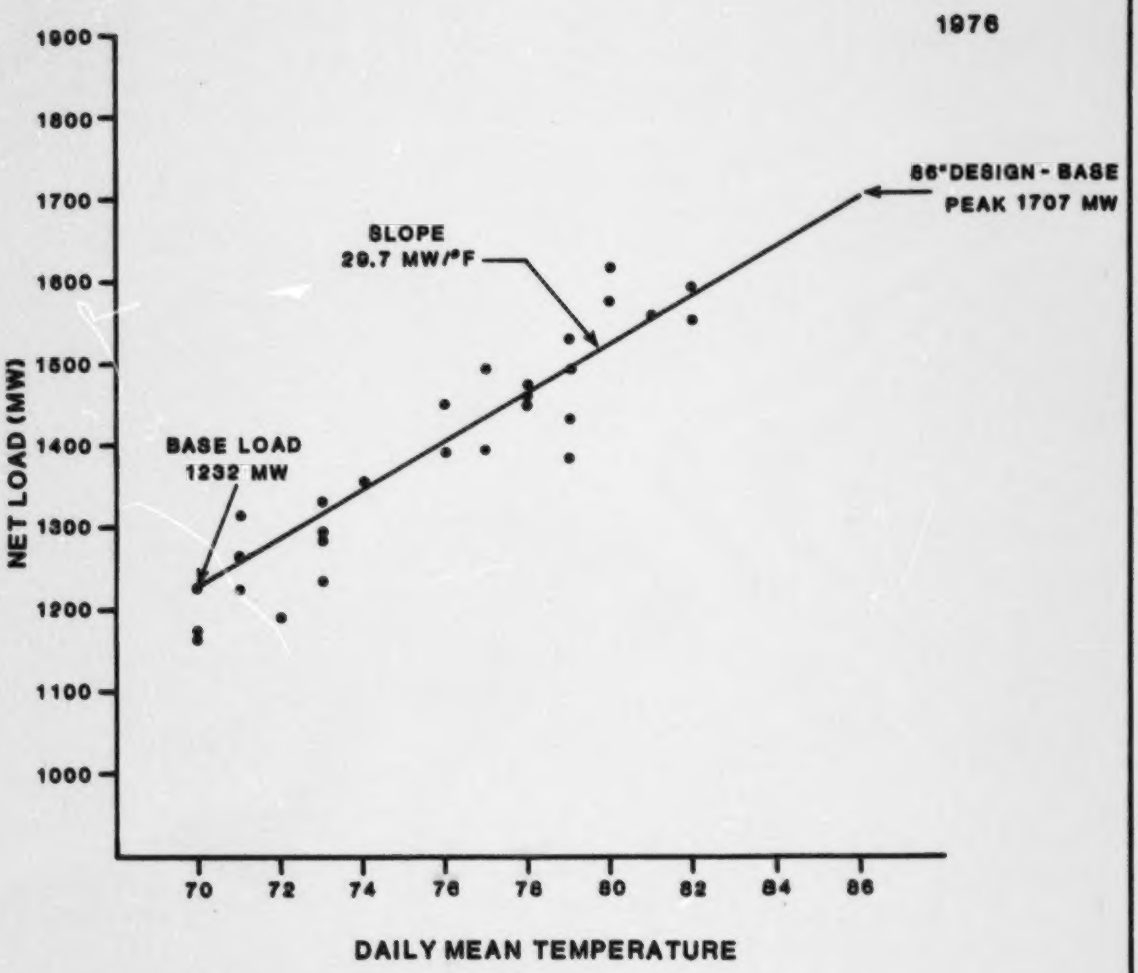


LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NET ELECTRICAL LOAD VS.
MEAN TEMPERATURE
1973, 1974, AND 1975

FIGURE 1.4.3-4

NOTE:
LOAD ADJUSTED FOR INDUSTRIAL VACATIONS



LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NET ELECTRICAL LOAD VS.
MEAN TEMPERATURE, 1976

FIGURE 1.4 .3-5

1.5 HISTORICAL AND PROJECTED NEED FOR POWER

Table 1.5-1 presents the historical and forecasted growth of the 50 percent potential average peak demand (see Section 1.4.2) of the four major components (major industrial, temperature-sensitive, gas conversion, and non-industrial base at 70°F) that determine what total generating capacity the Applicant must maintain to provide its system with a 20-percent reserve margin. Figure 1.5-1 plots these data. Appendix B presents tables and figures that break out the historical and actual data for each component (excluding gas conversion).

1.5.1 Historical Trends

Reasonably consistent growth occurred in the years 1965 through 1974. However, a significant departure is evident in the data for 1975 and 1976. Subsequent studies have revealed that the industrial sector had virtually no new growth in 1975 and 1976 and, indeed, actually had demands that were below normal levels of full production in previous years. This reduction in industrial demand approximately offset the residential and commercial demand growth for that year, which itself had a less-than-normal growth rate. (The temperature-sensitive component maintained its historical rate.)

1.5.2 Future Growth

Table 1.5.2-1 delineates the growth rates reflected in the Applicant's projected increases in demand for the years 1977 through 1990. Figure 1.5-1 plots the total growth versus the growth that could be expected on the basis of historical trends.

Major Industrial Component Growth

The large industrial growth rate is presently forecasted to range from 2 to 4 percent; this compares to growth rates as high as 6 to 7 percent in the 1960's. The reduced growth rate is projected on the basis of the trend in the Applicant's service area away from proportional increase in heavy industry, because of the limited number of suitable industrial sites and because of stricter air quality controls that limit the amount of additional industrial emissions that can be added to an area.

Temperature-Sensitive Component Growth

Factors affecting the growth of the temperature-sensitive component were discussed in Section 1.4.3. As noted, 65 percent of the Applicant's customers have cooling equipment. The installation of cooling units in existing structures by present customers is expected to continue until 80 percent of existing customers have cooling equipment. This saturation point is expected to be reached in the early 1990s. The second source of temperature-sensitive demand will come through the addition of new customers to the Applicant's system. From 1950 to 1974, residential customers were added to the Applicant's system at an average compounded annual rate of about 3 percent. This rate is expected to drop in the future, ranging from 1.0 percent in 1977 to 2.0 percent in 1981, and continuing at this rate until 1990.

TABLE 1.5-1

TOTAL HISTORICAL AND PROJECTED SYSTEM AVERAGE PEAK DEMAND (50-PERCENT POTENTIAL)[a]
LOUISVILLE GAS AND ELECTRIC COMPANY

Year	Non-Industrial Base @ 70°F	Temperature-Sensitive	Major Industrial	Gas Conversion	Composite Load @ 86°F Actual or Forecast	Composite Load @ 86°F Historical Data Base[b]
1965	389 MW	122 MW	285 MW		796 MW	818 MW
1966	411 MW	176 MW	300 MW		887 MW	887 MW
1967	435 MW	222 MW	297 MW		954 MW	963 MW
1968	442 MW	316 MW	330 MW		1,088 MW	1,045 MW
1969	507 MW	362 MW	347 MW		1,116 MW	1,134 MW
1970	553 MW	350 MW	357 MW		1,220 MW	1,230 MW
1971	597 MW	408 MW	365 MW		1,370 MW	1,334 MW
1972	664 MW	394 MW	375 MW		1,433 MW	1,448 MW
1973	683 MW	483 MW	405 MW		1,571 MW	1,571 MW
1974	770 MW	467 MW	430 MW		1,667 MW	1,704 MW
1975	745 MW	520 MW	385 MW		1,650 MW	1,849 MW
1976	832 MW	475 MW	400 MW	0 MW	1,707 MW	2,007 MW
1977	865 MW	499 MW	408 MW	6 MW	1,778 MW	2,177 MW
1978	909 MW	519 MW	416 MW	18 MW	1,862 MW	2,362 MW
1979	963 MW	541 MW	429 MW	42 MW	1,975 MW	2,563 MW
1980	1,030 MW	565 MW	442 MW	54 MW	2,091 MW	2,781 MW
1981	1,102 MW	590 MW	459 MW	60 MW	2,211 MW	3,017 MW
1982	1,191 MW	615 MW	478 MW	60 MW	2,344 MW	3,274 MW
1983	1,286 MW	639 MW	497 MW	60 MW	2,482 MW	3,552 MW
1984	1,386 MW	661 MW	517 MW	60 MW	2,624 MW	3,854 MW
1985	1,490 MW	680 MW	538 MW	60 MW	2,768 MW	4,182 MW
1986	1,598 MW	698 MW	559 MW	60 MW	2,915 MW	4,537 MW
1987	1,710 MW	714 MW	581 MW	60 MW	3,065 MW	4,923 MW
1988	1,825 MW	732 MW	604 MW	60 MW	3,221 MW	5,341 MW
1989	1,944 MW	749 MW	628 MW	60 MW	3,381 MW	5,795 MW
1990	2,065 MW	765 MW	653 MW	60 MW	3,543 MW	6,288 MW

Correlation Coefficient = .9951

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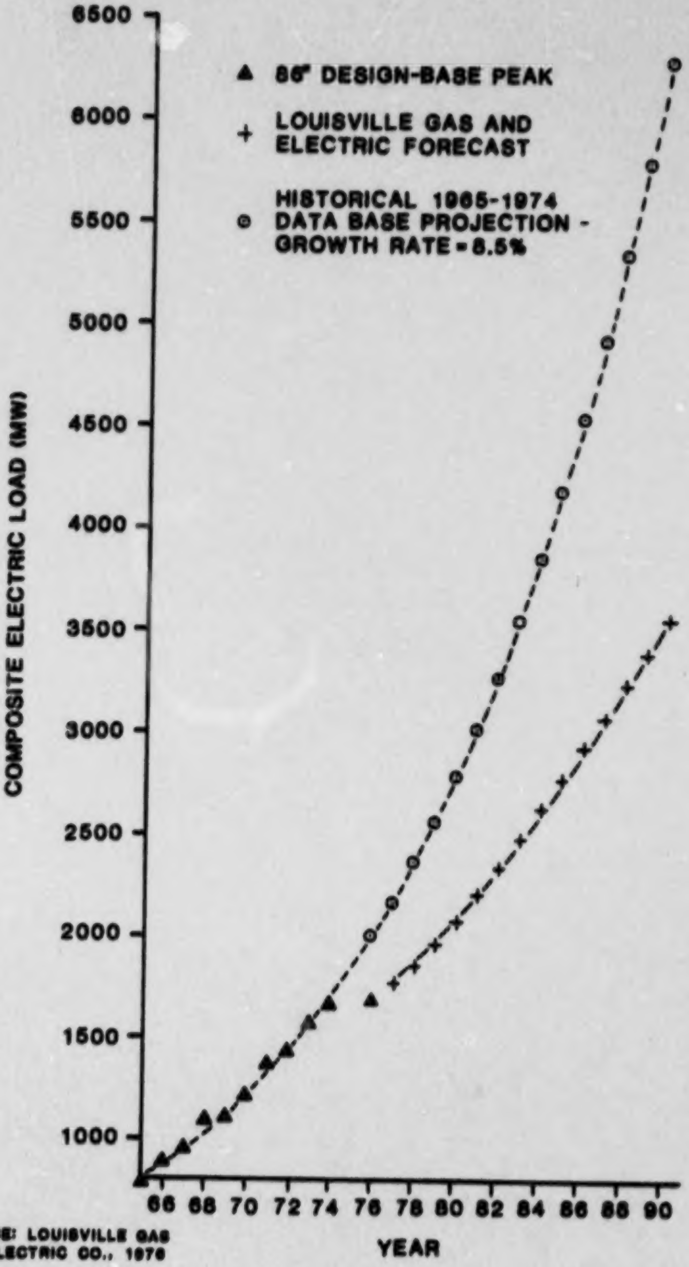
[a] See Section 1.4.2.

[b] Average peak demand (50-percent potential) that would be expected strictly on basis of historical trends.



SOURCE: LOUISVILLE GAS AND ELECTRIC CO., 1976

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

COMPOSITE LOAD AT 86° F

FIGURE 1.5-1

NOTE:
50% POTENTIAL AVERAGE PEAK

TABLE 1.5.2-1

PROJECTED DEMAND AND GROWTH RATES--LOUISVILLE GAS AND ELECTRIC COMPANY SYSTEM

Year	Non-Industrial Base @ 70°F MW (% increment)	Temperature-Sensitive	Major Industrial MW (% increment)	Gas Conversion	Composite Load @ 86°F	Percent Total Growth
1977	865 (4.00)	499	408 (2)	6	1,778	4.1
1978	909 (5.00)	519	416 (2)	18	1,862	4.7
1979	963 (6.00)	541	429 (3)	42	1,975	6.1
1980	1,030 (7.00)	565	442 (3)	54	2,091	5.9
1981	1,102 (7.00)	590	459 (4)	60	2,211	5.7
1982	1,191 (8.00)	615	478 (4)	60	2,344	6.0
1983	1,286 (8.00)	639	497 (4)	60	2,482	5.9
1984	1,386 (7.75)	661	517 (4)	60	2,624	5.7
1985	1,490 (7.50)	680	538 (4)	60	2,768	5.5
1986	1,598 (7.25)	698	559 (4)	60	2,915	5.3
1987	1,710 (7.00)	714	581 (4)	60	3,065	5.1
1988	1,825 (6.75)	732	604 (4)	60	3,221	5.1
1989	1,944 (6.50)	749	628 (4)	60	3,381	5.0
1990	2,065 (6.25)	765	653 (4)	60	3,543	4.9

Non-Industrial Base Load Growth

When it is considered that, by definition, the non-industrial component consists of everything that isn't either major industrial or the effect of temperature on load above a base mean temperature of 70°F, the magnitude of the types of loads in this component is evident. Not only does this represent new residential construction, which relates in part to population growth and number of persons per household, it also includes increased usage by existing customers, replacement of older housing with newer and larger housing (generally all electric), commercial and service operations, small industrial facilities, government services, recreational activities, new uses for electrical energy, base load air conditioning, and so forth.

The Applicant has based its residential customer growth on statistics developed by the Louisville Area Chamber of Commerce and on trends it was observing in its service area. These statistics are comparable to statistics taken from the 1972 OBERS projections for the Louisville SMSA, the Kentucky Program Development Office projections for the Jefferson ADD, and the joint state and local Housing Needs Analysis for Jefferson County. In fact, comparison of the statistics used by the Applicant with these other projections consistently points to the conservativeness of the Applicant's projections (see Table 1.5.2-2).

The Applicant recognizes that, in some areas, electric usage by existing customers is reaching a point of saturation. This would, on the surface, seem to militate against continuation of the historical load growth. However, there are many other new areas for which trends are developing; these can reasonably be expected at least to offset the low growth trends of older markets. The following paragraphs briefly touch on the areas of potential new demand for energy.

New housing construction is trending toward much larger, more fully electrically equipped units than did new construction in the past. Electric water heating and clothes drying in new construction will, in addition, replace what have been almost exclusively markets for gas.

While, for the purposes of projecting air conditioning saturation, homes equipped with window units are considered air conditioned, they still represent future increased demand. Many of the window units eventually will be replaced with larger central cooling units, especially when old furnaces are replaced.

Many homes now have color TV, but the market for new color sets is not near saturation. Frost-free refrigerators, dishwashers, freezers, trash compactors, home electrostatic dust filter systems, and many small appliances have as yet reached a very low point on the saturation curve and have a strong market capability.

The electric car and electric transit are vividly visible sources of potential new electric load of enormous magnitude that is not reflected at all in the historical growth pattern.

TABLE 1.5.2-2

LOUISVILLE GAS AND ELECTRIC COMPANY
COMPARISON OF DEMOGRAPHIC DATA

A. Population Projections - Louisville SMSA[a]

Year	Louisville Chamber of Commerce[b]		OBERS[c]	
	No. People	Growth Rate	No. People	Growth Rate
1950	576,900	-	576,219	-
1962	-	-	762,393	-
1970	826,553	1.84% ('50-'70)	827,927	1.87% ('50-'70)
1980	957,870	1.48% ('70-'80)	963,800	1.52% ('70-'80)
1990	1,115,112	1.54% ('80-'90)	1,146,300	1.59% ('80-'90)
2000	-	-	1,297,100	1.16% ('90-2000)
2020	-	-	1,568,500	1.73% (2000-2020)

B. Population Projections - Jefferson County

Year	Louisville Chamber of Commerce[b]		State and Local Government[d]	
	No. People	Growth Rate	No. People	Growth Rate
1970	695,055	-	695,055	-
1975	739,952	1.21% ('70-'75)	744,482	1.37% ('70-'75)
1980	793,440	1.43% ('75-'80)	800,507	1.45% ('75-'80)
1990	906,360	1.34% ('80-'90)	925,136	1.47% ('80-'90)
2000	-	-	1,063,915	-
2020	-	-	1,384,458	1.34% ('90-2020)

C. Persons Per Household - Jefferson County

Year	Louisville Gas and Electric		State and Local Government[d]	
	Persons/ Customer	Growth Rate	Persons/ Household	Growth Rate
1970	3.3240	-	3.2160	-
1975	3.0670	-1.39% ('70-'75)	3.1422	-0.50% ('70-'75)
1980	2.8600	-1.39% ('75-'80)	3.0591	-0.55% ('75-'80)

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[a] Louisville standard metropolitan statistical area population projections are for Jefferson County, Kentucky; Floyd and Clark Counties, Indiana.

[b] Prepared by the Louisville Chamber of Commerce Research Department, September 1973.

[c] U.S. Department of Commerce and U.S. Department of Agriculture, 1974, 1972 OBERS projections--economic activity in the U.S., Vol. 5, Standard metropolitan statistical areas, U.S. Water Resources Council, Washington, D.C.

[d] Housing Needs Analysis: Commonwealth of Kentucky, Kentucky Housing Corporation and Local Government, Kentucky Executive Dept. of Finance & Administration, 1974.

Residential users will also be responsible for new load growth in areas outside the home. New on the horizon are environmental concerns which create, among other things, a requirement to establish new or remodeled sewage treatment systems. Relative to existing dwellings, new construction tends to be further away from the core area of the city. These result in a diversification of service facilities, transportation, etc., which creates proportionally more associated load per household than was historically required.

Restaurants will go to electric cooking and water heating, so that the new restaurant will be a bigger load addition than it has been in the past.

Enclosed shopping malls are a relatively new trend. Not only are the stores air conditioned and brightly lighted, the pedestrian-ways are also artificially lighted in the daytime and fully air conditioned. The new store is often self-service, with all merchandise spread out in attractive displays in highly lighted areas. Until recently, bulk stock was kept in a dimly lighted, non-air conditioned warehouse or storeroom, while only sample items were displayed in the store.

The trend to diversifying the large central department store into multiple neighborhood or regional stores and the trend to specialty shops increase the average commercial space per customer over that historically required. This diversity and expansion create additional electric demand.

New offices depend on more and higher levels of artificial lighting. This significantly increases air conditioning requirements. These offices also tend to be in high-rise buildings, which have increased pumping and elevator loads. The increase in the use of computers represents a substantial increase in new load growth and creates still further air conditioning demand. (Because of the heat generated by lighting and equipment in commercial buildings, commercial air conditioning is turned on sooner [when outside temperatures are relatively low] than home air conditioning. Therefore, a substantial part of the commercial air conditioning load is actually included in the "non-industrial base load at 70°F" component.)

There appears to be enough evidence, from the loads in 1975 and 1976, to warrant a reduction in the historical growth rate of the non-industrial base load at 70°F component--at least in the near term until housing construction resumes its pre-recession pace. Although the historical growth rate has been 8.1 percent, the Applicant has projected a modest rate of 4.0 percent in 1977, which is seen reaching 8.0 percent in 1982. Then, the rate is expected to decline to 6.25 percent at the end of the period under consideration.

The intentional conservativeness with which the Applicant has projected the contribution to future demands by the other three components adds a further reason to project an adequate growth rate for this fourth component. It must allow for the contingency that the other components may have been underforecasted.

Total Load Growth

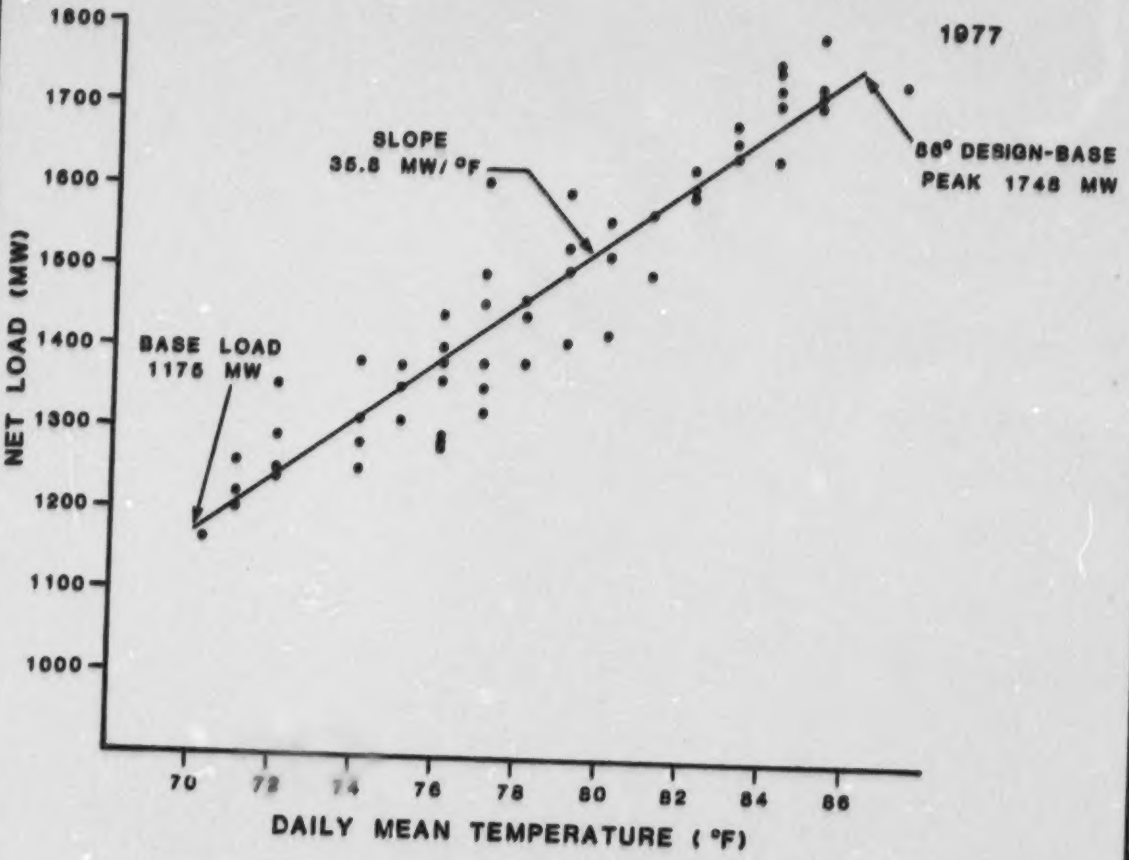
The final analysis is made by comparing the composite load of the four major components of the forecast to the composite load growth of recent history (Table 1.5.2-1 and Figure 1.5-1). Based on a 1965-1974 data base and an exponential curve-fit (as commonly used in the industry), the composite load growth shows an overall compound growth rate of 8.5 percent, which would project forward to 6,288 MW by 1990. However, the growth rate forecast by the Applicant ranges from 4.1 percent through 6.1 percent and back down to 4.9 percent by 1990. This is because, for the period 1975 through 1976, some (but less than full) economic recovery was assumed to occur. This is reflected particularly in the growth rate assigned to the industrial segment. The composite growth rate for 1976, therefore, was estimated to be 1.6 percent. From 1976 forward, a gradual increase in recovery of the economy, particularly in the large industrial sector, was projected. This is reflected in the 6.1 percent growth rate. However, this rate is predicted to decline to 4.9 percent (3,543 MW) by 1990. The Applicant believes that the potential for significant increases in the cost of electric energy and the sensitivity to, and recognition of, diminishing natural energy resources, might reasonably be expected to create an economic and moral pressure for conservation in new growth. Further, retrofitting of existing residential dwellings with air conditioning is expected to have reached saturation by this time. Therefore, a slower growth rate should be in effect by 1990.

1977 Summer Season Loads

A preliminary analysis of the actual 1977 summer load data was made for comparison to Applicant's forecast just before this Environmental Impact Statement was printed. In general, the 1977 actual loads confirm the reasonableness of the 1977 forecast. Although, because of normal and expected deviations, the load experience for 1 year is not necessarily conclusive proof of the accuracy of a forecast which spans more than a decade, the 1977 experience does seem to indicate that the trend of the Applicant's load forecast (i.e., growth rates substantially below those experienced during the 1960's and early 1970's) is justified.

The 1977 summer season load data are plotted in Figure 1.5.2-1. The 86° design base peak is shown to be 1,748 MW, as compared to 1,778 MW forecasted for the 1977 summer season. While this 86° design base peak for 1977 is well within the forecast accuracy the Applicant expects to achieve from year to year, the deviation within the components of that load indicate that a higher percentage of the air-conditioning load appeared in the temperature-sensitive component than contemplated in the forecast, resulting in a comparable lesser amount appearing as a part of the non-industrial base load component. The temperature sensitive component (1,748-1,175 = 573 MW) was higher (573 MW vs. 499 MW) than forecasted. Also, the non-industrial base load (1,175 MW base load - 426 MW industrial base load = 749 MW) was lower (749 MW vs. 865 MW) than forecasted. As stated, the deviations in these two components tend to be offsetting and the net effect on the 86° design base peak is rather small.

The trends noted in the 1977 load experience, if similarly observed in subsequent years, may result in minor, but offsetting, adjustments in the individual load components. However, there is no indication that the additional year's data, when correlated with the historical data and future trends represented in the current forecast, will materially affect the overall forecast or need for power as projected in the analysis of the Applicant's data as contained herein.



LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

NET ELECTRICAL LOAD VS.
MEAN TEMPERATURE, 1977

FIGURE 1.5.2-1

2.0 AREA OF INTEREST DESCRIPTION

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2.0 AREA OF INTEREST DESCRIPTION

Section 2.0 provides a general environmental description of the area chosen by the Applicant for siting of their proposed 2,340-MWe power plant. This area consists of those counties to which the Applicant provides electric service, either partially or wholly: Jefferson, Oldham, Bullitt, Meade, Hardin, Henry, Shelby, Spencer, and Trimble Counties (see Section 1.0 for details about the Applicant's service area). Counties peripheral to the service area were also screened for potential plant sites. Because it is extremely important that sites be near an adequate water supply (for cooling water) and fuel transportation routes, special attention was given to areas adjacent to major rivers and within reasonable distances of the Louisville load center and the Applicant's transmission system. Indiana was not considered for potential plant sites, however, because of the difficulty of licensing an out-of-state utility. The methodology and criteria used in the site selection study are presented in detail in Section 3.3.

An additional area screened for potential plant sites was the Western Coal Field and Green River basin area in Muhlenberg County. This location offers a nearby source of coal and an adequate supply of cooling water. However, because of its distance from the Applicant's load center and the extremely high costs of constructing a large-capacity power line, this area was eliminated from detailed consideration as an area of interest.

The following sections discuss the environment of the nine-county area of interest for location of the Applicant's proposed generating facility. Special emphasis is given those areas and environmental aspects that would be particularly sensitive or unsuited to construction and operation of a 2,340-MWe fossil-fueled generating plant.

2.1 THE ATMOSPHERE

Climate affects power plant siting in at least two major ways: the quantity of precipitation received annually determines the water available for power plant cooling, while wind, temperature, and humidity determine the way air emissions and the concentrations of air pollutants are diffused. Plant design is also affected by the frequency of occurrence of storms accompanied by high velocity winds.

Generally, sites in areas of minimum relief are more desirable because cooling towers and chimneys can be shorter than in valley locations and less reheat or effluent velocity is needed to elevate the chimney and cooling tower plumes above the terrain. In level areas, either mechanical draft or natural draft towers may be used; also, if natural draft towers are used, they need not be as tall as in areas where elevation differences are great. There are usually fewer local incidences of air drainage effects on natural fogging and icing or cooling tower plume-induced fogging and icing in areas of level terrain.

Three kinds of state and federal regulations concerning the maintenance of an acceptable level of air quality affect power plant siting: federal and state Ambient Air Quality Standards, federal and state New Source Performance Standards, and federal standards designed to prevent the significant deterioration of ambient air quality by pollutant emissions from a new source. These regulations are discussed in more detail in Sections 5.1.2 and 6.1.3. For power plant siting, the most stringent regulations that must be met are those governing the prevention of significant deterioration of air quality. These regulations put a limit (increment) on the amount of new concentrations of sulfur dioxide and particulate matter that may be added to those already existing in an area (see page 5-17).

2.1.1 Climate

The service area is typical of the Ohio River Valley and has a moderate continental climate with warm, humid summers and cold winters. Based on 85 years of records from Louisville, Kentucky, temperatures range from -19° to 107°F. Abundant precipitation is rather uniformly distributed throughout the year and is conducive to agriculture.

The prevailing (most frequently occurring) wind direction in the area is generally from the south through southwest, although there are seasonal variations. Due to the relatively light annual average wind speed and low mixing depth, meteorological conditions are occasionally conducive to the buildup of air pollutants, particularly during the late summer and autumn.

2.1.2 Air Quality

The Applicant's service area lies within two Air Quality Control Regions (AQCR's) in northern Kentucky. These are the North Central AQCR

(Trimble, Henry, Oldham, Shelby, Bullitt, Hardin, and Meade Counties); and the Louisville Interstate AQCR (Jefferson County in Kentucky and Floyd and Clark Counties in Indiana).

In the North Central AQCR, concentrations of sulfur dioxide and particulates are well below the primary standards (for an explanation of the various air quality standards, see Section 5.1.2). However, air quality sampling has been conducted in only six cities--Elizabethtown, Shelbyville, Bardstown, Leitchfield, LaGrange, and Shepherdsville. Consequently, air quality data for many areas are lacking.

Industrialization in the Louisville Interstate AQCR has caused frequent violations of the sulfur dioxide and total suspended particulate ambient air quality standards. Recognition of the air quality problem has resulted in the recent designation of the region as an Air Quality Maintenance Area (AQMA).

All areas of Kentucky, including parks (see Section 2.8.10) and AQMA's, are presently designated Class II (see Section 5.1.2) with respect to allowable increments of significant air quality deterioration. Additional degradation of air quality in Jefferson County would not be permitted due to the existing problems. A redesignation of the park and pristine areas to Class I, which would further restrict allowable degradation is not anticipated for approximately 1 or 2 more years (Lueck, 1975).

Generally, the service area is characterized by rolling hills; in parts of Jefferson, Bullitt, Hardin, and Meade Counties, these rise over 600 feet from the valleys. This could present a potential air quality problem due to plume impaction on the hills or to downwash effects. Within the Ohio River Valley, the flood plain is of varying width but is flanked on either side by bluffs that typically rise 400 feet from the valley floor. Air quality problems associated with plume impaction and downwash effects are likely to occur along the entire reach of the Ohio River.

2.2 THE LAND

Relief, drainage, soil and rock type, and geologic structure affect site development costs, determine the natural hazards to which the power plant will be subject over its economic life, and determine the magnitude of ground and surface water contamination problems and engineering costs incurred in environmental protection measures.

2.2.1 Physiography and Topography

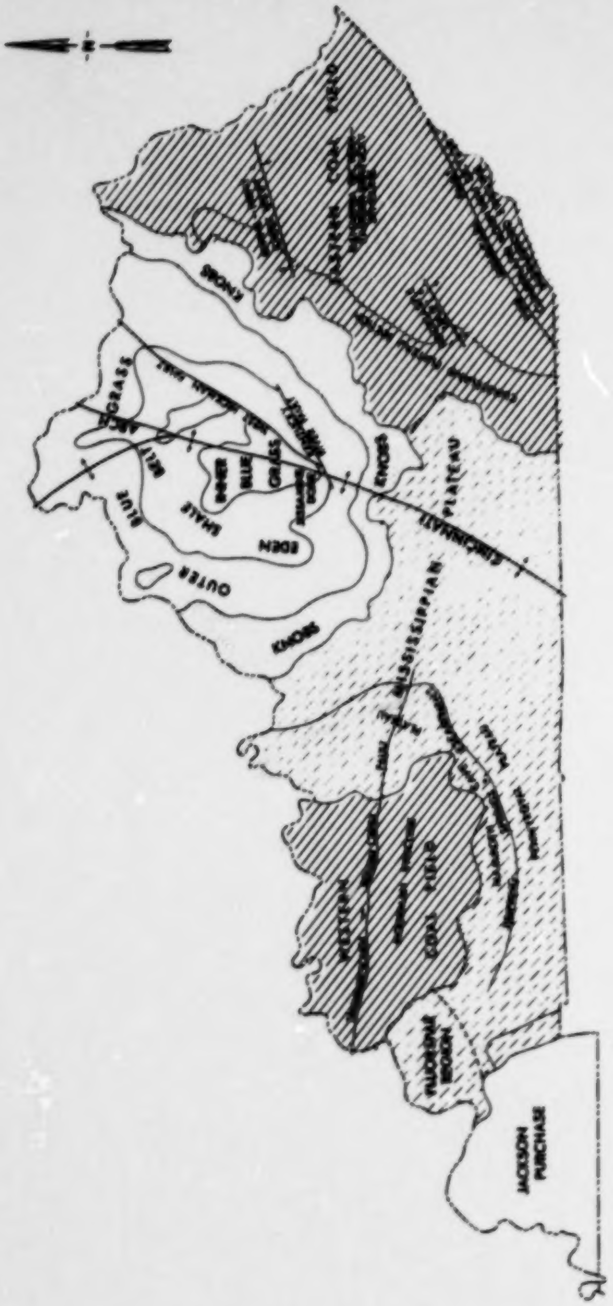
Most of the area of interest lies within the Bluegrass Region and Highland Rim Sections (Figure 2.2.1-1) of the Interior Low Plateau physiographic province, which includes all of central Kentucky from the Cumberland Plateau west to the Tennessee River.

Oldham, Henry, Shelby, Spencer, and Trimble Counties and parts of Bullitt and Jefferson Counties lie within the Outer Bluegrass Subsection of the Bluegrass Region (Figure 2.2.1-1). The remainder of Jefferson and Bullitt Counties and major portions of Hardin and Meade Counties lie within the Highland Rim Section, or "the Knobs," of the Pennyroyal District (see below); the southern portion of Hardin County and the western third of Meade County lie within the Shawnee Section of the Interior Low Plateau Province.

The physiographic provinces in Kentucky are directly linked to the surficial geology. The Bluegrass Region is an uplifted peneplain and is in the very early stages of stream dissection. The landscape is typically a flat or gently rolling upland, with stream valleys actively cutting deep into the peneplain.

Topographically, the Bluegrass Region is a great dome that has been nearly leveled by erosion at 900 to 1,000 feet above mean sea level near the center and sloping to lower elevations at its periphery. Thus, within the study area, elevations range from the normal levels of the McAlpine (420 feet) and Cannelton (383 feet) pools of the Ohio River to heights that approach 1,000 feet along the southern and eastern borders. The soils, derived largely from limestones, are generally very fertile, and the land surface is rather level above the bluffs of the Ohio River. The bluffs frequently are in excess of 300 feet in height and in many places are precipitous. Along the river edge there are extensive flood plains that may be several square miles in extent, but they are not continuous.

The Outer Bluegrass Subsection, which includes most of the service area, is primarily the outcrop belt of Late Ordovician strata belonging to the Cincinnatian Series. The Inner Bluegrass Subsection is an outcrop area of Middle Ordovician, Champlainian Series strata exposed at the center of the Lexington dome. At the southwestern border of the service area, a feature called the Highland Rim or "the Knobs" marks that boundary between the Bluegrass and Mississippian plateau regions. The Knobs are erosional remnants formed from the outcrop band of Devonian shales. These hills, often conical in shape, lie along the western edge



EASTERN COAL FIELD
KNOBS
BLUE GRASS
OUTER BLUE GRASS
EDEN SHALE BELT
INNER BLUE GRASS
CINCINNATI ARCH
MISSISSIPPIAN PLATEAU
WESTERN COAL FIELD
JACKSON PURCHASE

SOURCE:
KENTUCKY GEOLOGICAL SURVEY,1966,
FRESH SALINE WATER
INTERFACE MAP OF KENTUCKY.

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

PHYSIOGRAPHIC REGIONS AND MAJOR STRUCTURAL FEATURES OF KENTUCKY

FIGURE 2.2.1-1

of the Outer Bluegrass in a broad belt 10 to 15 miles wide. The hills are capped and preserved by weak sandstones and cherty limestones. Some of these hills rise more than 600 feet above the dissecting stream valley floors.

The Shawnee Section is a low plateau that lies largely on Mississippian sandstones and limestones. As noted, in the service area it is present only in southern Hardin County and western Meade County. The area is of generally low relief and is marked by karstic topography where soluble limestones underlie the sandstones. As a result, there are many caves and sinkholes, particularly in the extreme western and southwestern parts of the area under consideration.

North of Trimble County, beginning at the Indiana bank of the Ohio River, the landscape becomes more subdued and is characterized by the effects of continental glaciation. This region is known as the Till Plains Section of the Central Lowlands physiographic province and encompasses most of central Illinois, Indiana, and Ohio. The till plains of this province generally have low relief and contain stream valleys in a youthful to mature stage of dissection. Drainage is not directly controlled by bedrock structure or lithology because of the surficial blanket of glacial sediment that covers most of the region.

2.2.2 Geology

Stratigraphy

The oldest exposed strata of the region are of Ordovician age (see Figure 2.2.2-1) and occupy the central and eastern portions of the service area. Strata exposed in the western part of the service area, particularly in Oldham, Jefferson, and Bullitt Counties, become progressively younger. At the western border of the service area, bedrock outcrops pass from Ordovician to Silurian to Devonian and finally to Lower Mississippian at the western tip.

Strata of the Ordovician System (Figure 2.2.2-2) are present at the bedrock surface throughout the Cincinnati Arch structural province and are present in the subsurface throughout the region. The Bluegrass section of northern Kentucky is primarily formed on Ordovician strata, except for a narrow band of Silurian and Lower Devonian strata at the outer perimeter. The Upper Ordovician (Cincinnatian Series) strata form a thick sequence of interbedded shale, limestone, and dolomite. These strata are exposed throughout the Outer Bluegrass and Eden Shale Belt physiographic subsections (Figure 2.2.2-1). Middle Ordovician (Champlainian Series) strata are composed of a massive limestone and dolomite sequence, with a few beds of sandstone and shale. These strata form the Inner Bluegrass Region and are exposed by erosion at the center of the Lexington (Jessamine) structural dome. The Lower Ordovician (Canadian Series) strata are also composed mostly of a thick limestone and dolomite sequence and are present throughout the region in the subsurface.

The Silurian strata include a relatively thin sequence of massive limestone and dolomite beds, and a few thin shale beds. The massive

ERA	PERIOD	AGE (millions of years B.P.)
Cenozoic	Quaternary	Present to 2 ± 1
	Tertiary	2 ± 1 to 65 ± 2
Mesozoic	Cretaceous	65 ± 2 to 135 ± 5
	Jurassic	135 ± 5 to 190 ± 5
	Triassic	190 ± 5 to 225 ± 5
Paleozoic	Permian	225 ± 5 to 270 ± 5
	Pennsylvanian	270 ± 5 to 320 ± 5
	Mississippian	320 ± 5 to 340 ± 5
	Devonian	340 ± 5 to 400 ± 10
	Silurian	400 ± 10 to 430 ± 10
	Ordovician	430 ± 10 to 500 (?)
	Cambrian	500 (?) to 600 (?)
Precambrian		600 (?) to 1.5 billion (?)

Source: H. Faul, 1966.

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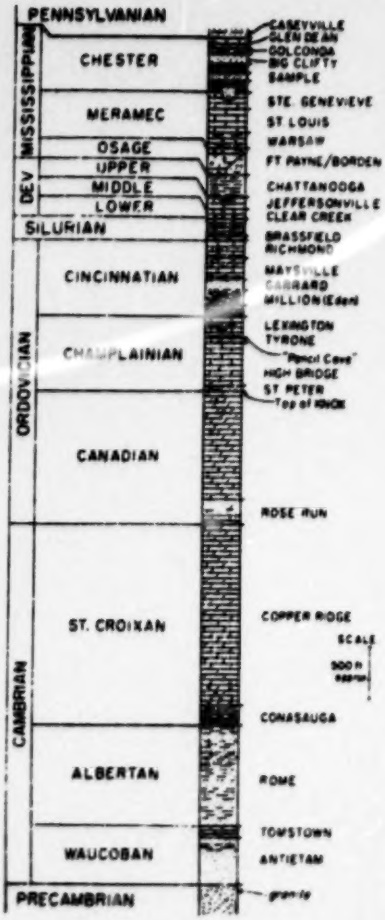
TRIMBLE COUNTY GENERATING PLANT

GEOLOGIC TIME SCALE

FIGURE 2.2.2-1


PENNSYLVANIAN
MISSISSIPPIAN
CHESTER
MERAMEC
OSAGE
DEV
UPPER
MIDDLE
LOWER
SILURIAN
ORDOVICIAN
CINCINNATIAN
CHAMPLAINIAN
CANADIAN
CAMBRIAN
ST. CROIXAN
ALBERTAN
WAUCOBAN
PRECAMBRIAN
CASEYVILLE
GLEN DEAN
GOLCONDA
BIG CLIFTY
SAMPLE
STE. GENEVIEVE
ST LOUIS
WARSAW
FT PAYNE/BORDEN
CHATTANOOGA
JEFFERSONVILLE
CLEAR CREEK
BRASSFIELD
RICHMOND
MAYSVILLE
GARRARD
MILLION (Eden)
LEXINGTON
TYRONE
"Pencil Cave"
HIGH BRIDGE
ST PETER
Top of KNOX
ROSE RUN
COPPER RIDGE
SCALE
500 ft
approx
CONASAUGA
ROME
TOMSTOWN
ANTIETAM
granite

SOURCE:
FUTURE PETROLEUM PROVINCES
OF THE UNITED STATES-
THEIR GEOLOGY AND POTENTIAL,
1971, AAPG, MEMOIR 15,
V.2, 1971, PAGE 1170.

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

GENERALIZED GEOLOGIC COLUMN
OF REGIONAL PALEOZOIC STRATA

FIGURE 2.2.2-2

carbonate strata form a karstic or sinkhole topography along the north-south trending outcrop belt that ranges from Trimble County on the north, Meade County on the west, to Bullitt County on the south. Joints are usually opened to a substantial degree by ground water solution activity. Ground water (and any water-borne contamination) is carried along these open joints, although the rock itself is tight and has very little primary permeability. Percolation of ground water (and chemical solutions contained in it that result in openings along joints) continues downward until it is interrupted by one of the shale beds. Ground water is usually discharged just above these shale strata and forms contact springs along a valley wall.

Strata of Lower and Middle Devonian age are massive carbonates, similar to the Silurian carbonates previously described.

Upper Devonian strata consist of a thick sequence of dark shale. These shales naturally form gentle slopes and subdued topography.

Mississippian age strata are mostly massive carbonate beds that form an outcrop belt of highly developed karstic topography (Mammoth Cave and other well-known caverns lie within this belt).

Pleistocene deposits are mostly associated with periods of glaciation. Sand and gravel outwash fills the channel of the Ohio River, except for a thin upper layer of recent alluvial silt that covers most of the flood plain.

Structure

The service area lies predominantly within the Central Stable Region. The closest orogenic region is the Appalachian orogenic belt, which lies about 150 miles southeast of the plant site at its closest approach.

The Central Stable Region is a tectonically stable area, characterized by gently dipping Paleozoic sedimentary strata overlying a Precambrian basement complex of igneous and metamorphic rocks. Large structural basins (downwarps) and structural arches (upwarps) have been active primarily throughout Paleozoic time. Both the dominant and subordinate regional structural features of the area are illustrated on Figure 2.2.2-3.

The service area is located on the west flank of the Lexington dome, a structurally high portion of the Cincinnati Arch (Figure 2.2.2-1). The eastern shelf of the Illinois Basin lies further west, forming the Pennsylvanian coal fields of southern Indiana and western Kentucky. All of the exposed Paleozoic strata dip gently towards the west at about 20 to 40 feet per mile.

The Cincinnati Arch is a north-south trending structure separating the Illinois Basin on the west from the Appalachian Basin on the east. On its northern end, the Cincinnati Arch bifurcates into the northwest trending Kankakee Arch and the northeast trending Findlay Arch. On its southern reach, the crest of the Cincinnati Arch undulates, forming the

Lexington dome, the Cumberland saddle, the Nashville dome, and other minor structural irregularities.

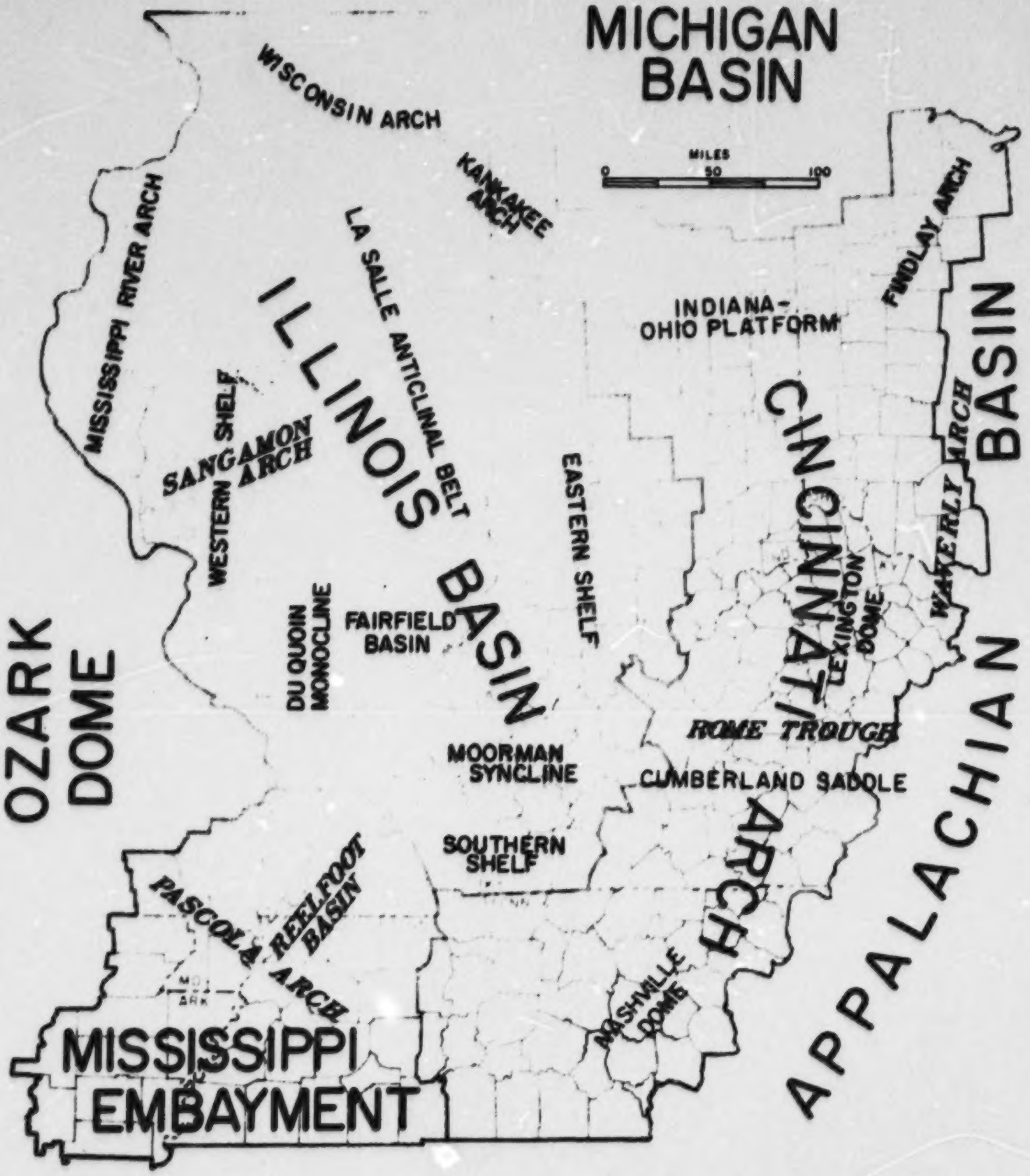
The Illinois Basin is the dominant structural feature west of the service area. The deepest portion is the Fairfield Basin, where the Paleozoic sedimentary sequence exceeds 14,000 in thickness. Subordinate anticlinal and synclinal trends within the basin have resulted from minor warping of the Precambrian basement.

The Mississippi Embayment at the southeastern corner of the region is a structural trough that developed during the Late Cretaceous and continued to subside intermittently until the end of the Eocene Epoch. The Mississippi Embayment is external to the geology of the service area and is not contained within the Central Stable Region.

The major faults and crypto-volcanic disturbances within the region are illustrated on Figure 2.2.2-4. The most predominant fault system is the Rough Creek lineament, including the Rough Creek fault zone on the western side of the region, and the Kentucky River fault zone on the eastern side. Fault patterns are generally complex, both along the Rough Creek lineament and along the associated branch systems. Structural displacement has affected Pennsylvanian age strata but not the Tertiary strata of the Mississippi Embayment area. Therefore, movement along this fault system is dated as post-Pennsylvanian and pre-Tertiary in age.

The regional north-south trending fault systems are relatively discontinuous and less frequent than the east-west trending systems. West of the service area, the closest major north-south trending fault is the Mt. Carmel fault. Movement along the Mt. Carmel fault probably began in the Late Mississippian and ended by the Early Pennsylvanian. East of the plant site, the Little Hickman-Bryan Station fault zone is the closest major north-south trending lineament and has been tentatively dated as having occurred during the late Paleozoic era.

Crypto-volcanic disturbances occur on both the north and south side of the Rough Creek lineament. These are very local structures that are intensely fractured and are believed to have been unsuccessful attempts at volcanic eruptions. The crypto-volcanic structure closest to the plant site is the Jeptha Knob disturbance of eastern Shelby County, Kentucky. Jeptha Knob is dated as Early Silurian, and undisturbed beds of Middle Silurian age cap the structure. Jeptha Knob is complexly faulted and has an exposed core of older Ordovician strata. The structure is very localized and has a diameter of only 3 or 4 miles. Other crypto-volcanic disturbances in the region are probably similar in age.

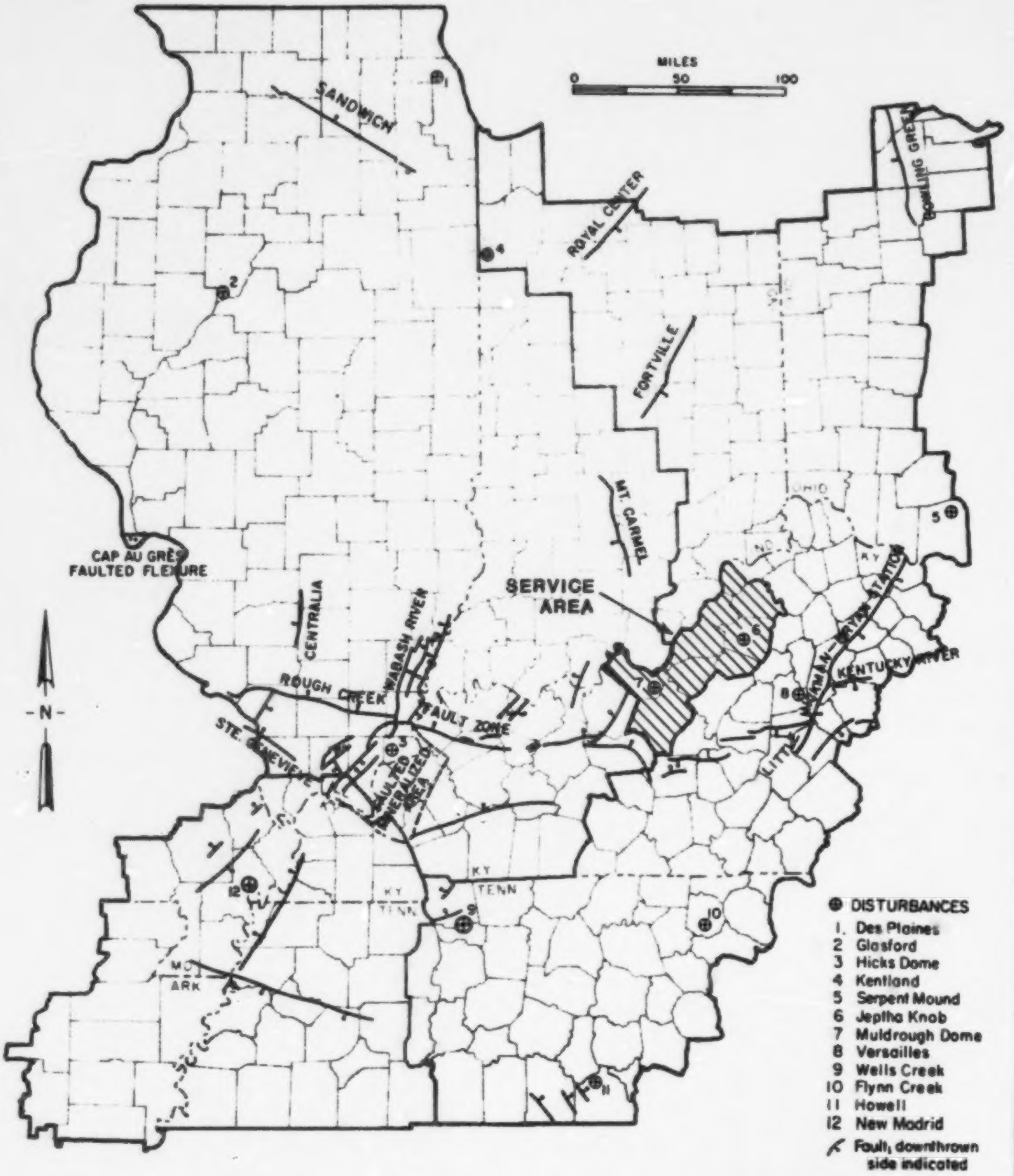

MICHIGAN BASIN
WISCONSIN ARCH
KANKAKEE ARCH
MILES
0
50
100
MISSISSIPPI RIVER ARCH
LA SALLE ANTICLINAL BELT
ILLINOIS BASIN
FINDLAY ARCH
INDIANA-OHIO PLATFORM
BASIN
WESTERN SHELF
SANGAMON ARCH
EASTERN SHELF
CINCINNATI ARCH
WAVERLY ARCH
LEXINGTON DOME
OZARK DOME
DU QUOIN MONOCLINE
FAIRFIELD BASIN
ROME TROUGH
MOORMAN SYNCLINE
CUMBERLAND SADDLE
APPALACHIAN
SOUTHERN SHELF
PASCOLA ARCH
REELFOOT BASIN
MO
ARK
NASHVILLE DOME
MISSISSIPPI EMBAYMENT

SOURCE:
ILLINOIS STATE
GEOLOGICAL SURVEY
ILLINOIS PETROLEUM 96 P. 22.

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

STRUCTURAL FEATURES
OF THE EASTERN INTERIOR REGION

FIGURE 2.2.2-3


MILES
0
50
100
SANDOWICH
ROYAL CENTER
FORTVILLE
BOWLING GREEN
MT. CARMEL
OHIO
IND.
KY
CAP AU GRÈS FAULTED FLEXURE
CENTRALIA
WABASH RIVER
SERVICE AREA
ROUGH CREEK
FAULT ZONE
STE. GENEVIEVE
FAULTED MINERALIZED AREA
LEXINGTON-KY-STATION
KENTUCKY RIVER
LITTLE
KY
TENN
MO
ARK
N
1
2
3
4
5
6
7
8
9
10
11
12
DISTURBANCES
1. Des Plaines
2. Glasford
3. Hicks Dome
4. Kentland
5. Serpent Mound
6. Jeptha Knob
7. Muldraugh Dome
8. Versailles
9. Wells Creek
10. Flynn Creek
11. Howell
12. New Madrid
Fault, downthrown side indicated

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

MAJOR FAULTS AND DISTURBANCES IN THE EASTERN INTERIOR REGION

FIGURE 2.2.2-4

SOURCE:
ILLINOIS STATE GEOLOGICAL SURVEY
ILLINOIS PETROLEUM 96 P. 25.

Seismicity

The entire service area is located in a region defined as Zone 2--expected moderate damage--as determined by the National Oceanic and Atmospheric Administration (1972).

Mineral Resources

Significant mineral resources and industries are summarized as follows:

1. Sand and gravel processing plants along the Ohio River flood plain--two in Carroll County and five in Jefferson County at Louisville
2. Crushed stone quarries--10 quarries along the Lower Devonian and Silurian outcrop belt, all in limestone or dolomite
3. Oil and gas fields--none being used in the service area, though there are areas of rock structure used for underground gas storage

2.2.3 Soils

Although all soils of Kentucky have not been mapped, the principal soil divisions and major soil associations correspond very closely with the boundaries of the physiographic provinces. Generally speaking, the soils of the Bluegrass Section are the most fertile and amenable to agriculture, but become progressively less so in the Highland Rim and Shawnee Sections. The soils are mostly podzolic and range in color from yellowish or reddish brown through gray-brown to dark brown.

Glaciers of the most recent Wisconsin Age did not reach the Ohio River, but earlier glaciers of the Illinoian "ice age" terminated at or slightly beyond the Ohio River in Kentucky. The northwestern half of Trimble County was covered by the Illinoian glacier, although the southern terminus of the ice sheet barely touched the adjacent northern counties in the Louisville Gas and Electric Company service area. Soil deposits directly associated with the Illinoian glacier usually include a thin layer of glacial till overlying bedrock. Loess (windblown silt) is usually found as surficial deposits in areas near the glacial terminus. The loess is generally thin and forms a wedge that pinches out rapidly towards the south, away from the ice front.

2.2.4 Terrestrial Flora and Fauna

Flora

Vegetation, other than agronomic or horticultural crops, is typical of the Western Mesophytic Forest Region as described by Braun (1950). It is a mosaic of unlike climaxes and subclimaxes and generally is ecotonal in nature. Oak-hickory forests or prairie communities are not uncommon but also are not extensive. Edaphic and secondary communities are scattered throughout the area, giving it a very complex floral structure. The extent of diversity of the flora within the service area, including that of the Ohio River, is indicated by the presence of more than 100 different families of plants that range from the algae and rooted plants in the river through the mosses and liverworts, grasses and sedges, to the composites. In addition, there are extensive stands of second growth timber, especially in the hilly areas and ravines where the soils cannot be tilled.

Seilheimer (1963) identified 168 species of phytoplankton, including the diatoms, from the Ohio River at Louisville.

The riparian vegetation includes cottonwood, American elm, red elm, several species of maple, ash, hickory, black walnut, river birch, and other species common to the lowlands of the Western Mesophytic Forest Region (Braun, 1950).

Rare and endangered species likely to appear in the service area are discussed in Section 2.8.5.

Fauna

The amphibians and reptiles of the service area may be considered, in many respects, as transitional between the eastern and western faunas as well as between the northern and southern. Still, there are about 30 amphibian species and a similar number of reptile species known from the area. The amphibians include frogs, toads, salamanders, mudpuppies, sirens, and hellbenders. The reptiles include turtles, snakes, and lizards.

In a recent study of the nesting bird population of the area, 74 species were listed. Among those not included in the list, but likely to be present in the area, were at least four species of owls, three species of goatsuckers, and many species of migratory waterfowl; the latter frequent the area during their spring and fall migrations. Waterfowl, mourning doves, and bobwhite are the principal sport species of the area.

There is nothing remarkable about the mammalian fauna of the area under consideration. Common among the mammals are opossum, shrew, mole, bat, cottontail, chipmunk, ground squirrel, tree squirrel, woodchuck, flying squirrel, mice, vole, woodrat, muskrat, red fox, gray fox, mink, striped skunk, and the white-tailed deer. Squirrel, woodchuck, cottontail, and white-tailed deer are the principal sport species.

Rare and endangered species likely to appear in the service area are discussed in Section 2.8.5.

2.3 THE WATER

This section provides a general description of the regional ground and surface water hydrological setting, with emphasis on items important to siting of a fossil-fuel power plant, including water availability, flood hazards, and water quality, standards, and uses.

Surface water hydrology constitutes one of the most significant areas of concern in the siting investigations for fossil-fuel power plants. The major plant structures must be protected to ensure normal plant operation during severe floods. The availability of an adequate and reliable long-term water supply largely defines the plant capacity and permissible cooling modes at a potential site. The suitability of sites for anticipated plant effluents as they relate to water quality standards in the receiving streams is also an important consideration.

2.3.1 Identification

Ground Water

Ground water resources in Kentucky are primarily limited to bedrock aquifers, except for the sand and gravel outwash that fills the Ohio River buried valley. Most of the service area is underlain by limestone and shale that yield from 0.1 to 10 gallons per minute (gpm) from drilled wells.

Surface Water

The major surface water features of the service area include the segment of the Ohio River from Madison, Indiana (River Mile 558) to the downstream boundary of Meade County (River Mile 691), the lower Kentucky River, the northern Salt River, portions of the Green River, and a number of Kentucky tributaries of the Ohio River. The streams are shown on Figure 2.3.1-1 and characterized by streamflow data given in Appendix C.

By far, the most abundant source of surface water in the service area is the Ohio River. Its drainage area at Louisville is 91,180 square miles and its average annual runoff is 16.73 inches per year (U.S. Geological Survey, 1974a). The Ohio River is highly regulated by numerous main-stem and tributary reservoirs, most of which have been constructed by the U.S. Army Corps of Engineers since the early 1930's. The main-stem locks and dams permit a large volume of river navigation.

The northeastern portion of the service area lies within the Kentucky River basin. At its mouth, the Kentucky River has a drainage area of 6,966 square miles (Commonwealth of Kentucky, 1965), and an average annual runoff of 17.87 inches per year (U.S. Geological Survey, 1974a). Similar to the Ohio River, the Kentucky River is also regulated by a number of upstream reservoirs; 14 locks and dams along its main stem allow navigation use.

The central part of service area is located in the Salt River basin. The Salt River, which drains 2,920 square miles (Commonwealth of Kentucky, 1965), discharges to the Ohio River about 15 miles downstream from Louisville. Its average annual runoff is about 17.5 inches per year (U.S. Geological Survey, 1974a). The Salt River's flow will be partially controlled by Taylorsville Dam and Reservoir, presently under construction by the U.S. Army Corps of Engineers, on one of its upstream tributaries (U.S. Army, 1974).

The extreme southwestern portion of the service area lies within the Green River basin. The Green River is regulated by four large U.S. Army Corps of Engineers reservoirs. Navigation is provided on the Green River by a series of five locks and dams. The Green River discharges to the Ohio River approximately 25 miles downstream from Owensboro, Kentucky. It has a drainage area at its mouth of 9,229 square miles (Commonwealth of Kentucky, 1965), and an average annual runoff of 19.3 inches per year (U.S. Army, 1974).

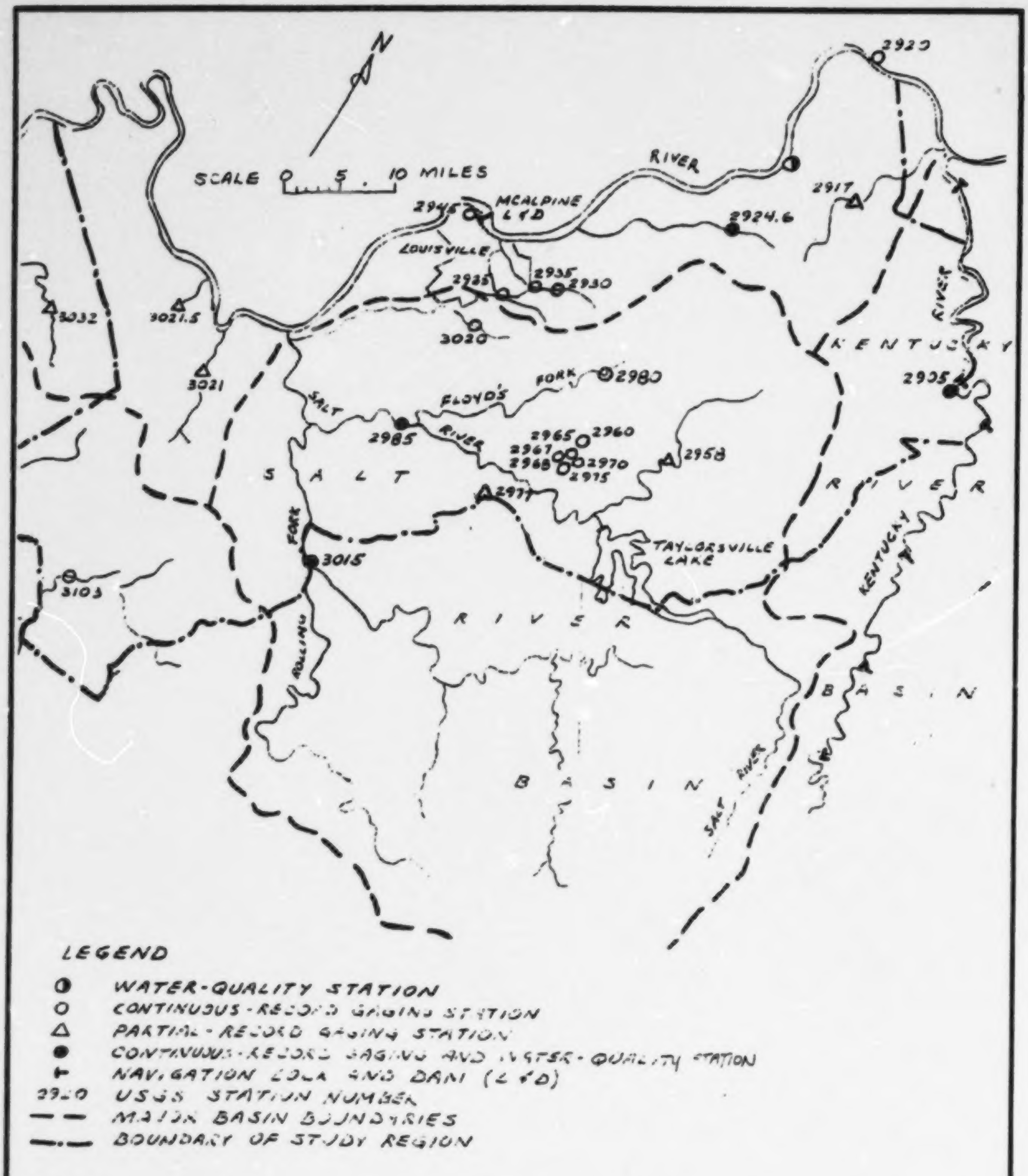
In addition to the above major river basins, a number of minor tributaries--many of them small, intermittent streams--within the service area discharge directly to the Ohio River. These tributaries, from upstream to downstream, are:

Patton's Creek	River Mile 576.2
Eighteen Mile Creek	River Mile 580.8
Harrods Creek	River Mile 595.8
Goose Creek	River Mile 597.6
Beargrass Creek	River Mile 602
Upper Paddy Run	River Mile 612.2
Lower Paddy Run	River Mile 613
Cane Run	River Mile 616.4
Mill Creek	River Mile 625.5
Salt River	River Mile 630
Otter Creek	River Mile 636.5
Doe Run	River Mile 642.3

Draining much of eastern Oldham County, Shelby County, and Spencer County are several tributary creeks of the Salt River--Floyd's Fork, with its headwaters in eastern Oldham County; Brashears Creek, and its feeding streams--Guist, Clear, and Bullskin Creeks; Plum Creek, Beech Creek, Little Beech Creek, and Crooked Creek in Spencer County. Floyd's Fork and its tributary streams also drain much of Bullitt County.

The northern portion of Hardin County is drained by the Rolling Fork of the Salt River and by Otter Creek (see above). The southern and southwestern parts of the county are drained by the headwaters of the Nol[illegible] and the Rough Rivers, respectively.

Meade County has few surface streams--Doe Run (see above), and Wolf Creek and Spring Creek on the county's western boundary, which enter the Ohio at River Mile 676.7 and River Mile 686.1. Trimble County streams are described in 5.3.


N
SCALE 0 5 10 MILES
RIVER
2920
2917
2946
MCALPINE L & D
2924.6
LOUISVILLE
2935
2935
2930
3020
3032
3021.5
3021
KENTUCKY
RIVER
2905
SALT
FLOYD'S FORK
2980
2985
RIVER
2965
2960
2967
2968
2970
2975
2958
SALT
2977
RIVER
FORK
3015
TAYLORSVILLE LAKE
KENTUCKY
3103
ROLLING
RIVER
BASIN
BASIN
SALT RIVER
LEGEND
● WATER-QUALITY STATION
○ CONTINUOUS-RECORD GAGING STATION
△ PARTIAL-RECORD GAGING STATION
● CONTINUOUS-RECORD GAGING AND WATER-QUALITY STATION
NAVIGATION LOCK AND DAM (L & D)
2920 USGS STATION NUMBER
MAJOR BASIN BOUNDARIES
BOUNDARY OF STUDY REGION

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

HYDROLOGIC BASE MAP

FIGURE 2.3.1-1

2.3.2 Water Quantity

Ground Water

Most of the service area is underlain by limestone and shale that yield from 0.1 to 10 gallons per minute (gpm) from drilled wells. Wells penetrating the sand and gravel aquifer along the Ohio River flood plain yield from 200 to 1,500 gpm. On the uplands, dug wells that terminate at or near the bedrock surface are in common use.

Ground water supplies sufficient water for regional domestic use (7,500 gallons per day [gpd]) from wells situated on alluvium and along drainage lines (Hall and Palmquist, 1960; Palmquist and Hall, 1960; Brown and Lambert, 1963; Gallaher and Price, 1966). Upland wells and wells situated away from drainage lines usually fail to yield a usable quantity of water.

It has been estimated that ground water contributes 15 to 30 percent of annual stream flow in the Bluegrass Region (Hendrickson and Krieger, 1964). This estimate can be applied to much of the service area as well. Surface streams in Meade and Hardin Counties, located in the Mississippian Plateau Region, receive a greater ground water contribution due to solution basins and karstic topography.

Surface Water

Average precipitation in the service area ranges from 42 to 44 inches of rain annually. Surface runoff is rapid due mainly to impermeable strata (limestones, shales, and siltstones). In summer, many of the smaller streams become intermittent, while the larger streams tend to pool or to maintain a low flow (1 to 3 cubic feet/second [cfs]). Many of the streams that have gauging stations have no flow or only very low flow registered for the 7-day, 10-year low flow. Appendix C provides a summary of streamflow characteristics at continuous gauging stations in the service area, including station numbers and names, drainage areas, periods of record, maximum instantaneous and minimum and average discharges, and (where available) the statistical 7-day, 10-year low flow.

Streamflows in the service area are extremely variable. Maximum instantaneous (flood) discharges are very high, as would be expected in areas with large topographic relief. Ratios of peak flood discharges to average discharges for the smaller tributary streams range from 90 to 325 as compared to the same ratio for the highly regulated Ohio, Kentucky, and Green Rivers, whose ratios are 15, 10, and 19, respectively. This is true even though the average annual discharges per square mile for the streams are nearly the same. This indicates that flash-flood conditions can be expected on the smaller tributaries.

Flood-hazard considerations are highly site specific. Therefore, it would be impractical to define the areas and depths of flooding at all points in the service area. However, available information on expected flood elevations along the Ohio River in the service area is given in Figure 2.3.2-1.

Many of the smaller streams in the service area exhibit extremely low discharges at times; the minimum discharges of record for several of the stations were zero flow. Examples of the 7-day, 10-year low flow averages for some of these streams follow:

County	Stream	cfs
Meade	Doe Run	5.2
	Otter Creek	4.0
Hardin	Nolin River	34.0
	Rolling Fork	1.7
Jefferson	Beargrass Creek	0.1
Oldham	Harrods Creek	0.2

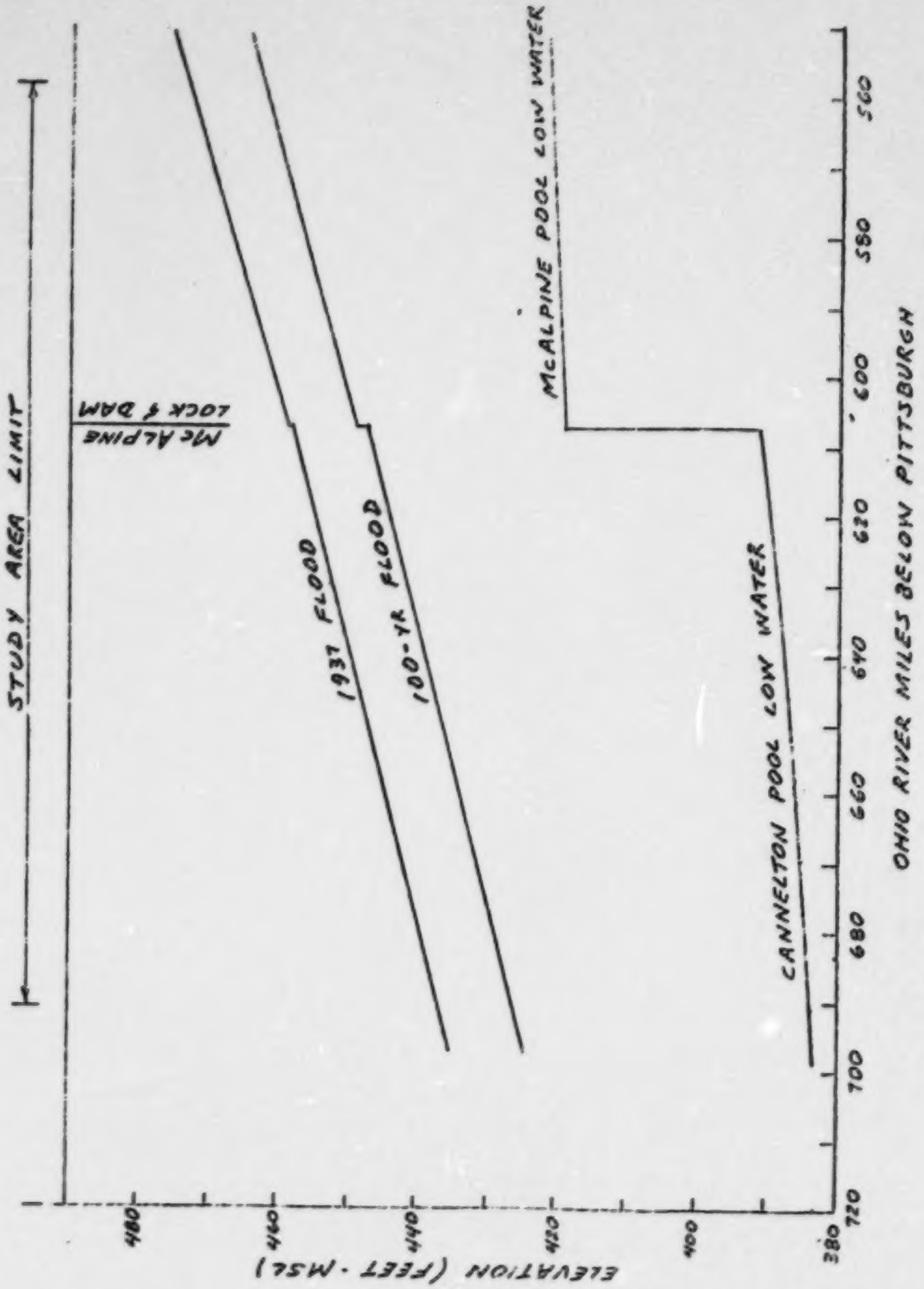
These data indicate that small tributaries cannot provide significant or consistent surface water supply without large storage facilities.

The amount of storage necessary to provide an adequate water supply for a proposed power plant depends on the flow characteristics of the stream from which the withdrawals are to be made. Therefore, no precise estimates can be made of required storage until sites are identified and detailed study undertaken. However, the following guideline is suggested. The guideline is based on three assumptions. First, the amount of sustained withdrawal may not exceed 10 percent of the average flow of the stream under consideration. Second, sufficient storage will be provided to meet water-supply demands and a minimum downstream flow no less than the historical 7-day, 10-year streamflow. Third, the average discharge of a typical stream is assumed to be 1.3 cfs per square mile (a typical value for tributaries in the service region). Based on these assumptions, for each 10 cfs of water-supply withdrawal, 77 square miles of drainage area will be required for the stream under consideration. If the additional assumption is made that withdrawal from storage will be required for nine consecutive months during critical low-flow years, each 10 cfs water-supply rate will require approximately 6,000 acre-feet of storage.

2.3.3 Water Quality

Ground Water

Because the bedrock aquifers are relatively impermeable, the saline connate water (water trapped in rock since its deposition) has not been hydrodynamically flushed by meteoric water (precipitation) to a significant depth. Water produced by deeper wells is usually brackish and becomes saltier with increasing depth. Sulfur water is sometimes encountered in wells and springs. Bullitt's Salt Lick near the Salt River has been a notable salt supply since pioneer days.



LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

OHIO RIVER FLOOD
EXPECTANCY PROFILE

FIGURE 2.3.2-1

The fresh-salt water interface lies approximately at elevation 400 feet (mean sea level) along the Ohio River, and at 700 or 800 feet in the upland reaches. Numerous springs in Meade and Hardin Counties have low to medium chlorine concentrations of 3 to 100 parts per million (ppm) (Hopkins, 1966).

Surface Water

The water quality of surface streams and ground water over the nine-county service region is generally good or acceptable. Appendix D presents recently measured maximum and minimum concentrations of selected water quality parameters on the Ohio River, Kentucky River, Harrods Creek, Salt River, Rolling Fork, and Green River. Table 7 of Appendix D explains the significance of those selected parameters with regard to possible use of the stream for water supply or discharge for the proposed plant.

Because of the limestone, calcareous shale, and siltstone strata, water throughout the service area is generally medium-hard to very hard (75 to 250 ppm total alkalinity). The water usually has a slightly alkaline pH ranging from 7.0 to 8.4 and is well buffered due to the carbonate-bicarbonate system. Cation balance is normal for alkalinities of the above range--Ca > Mg > Na > K. Specific conductance will usually range from 300 to 600 microhmos. Seasonal cycles cause the smaller streams of the area to show greater variations in dissolved solid concentrations (residue at 105°C) than the area's larger, permanent streams. These concentrations range from 150 to 500 ppm chlorinity (salinity).

Coliform counts in the Ohio River at Louisville, Kentucky vary widely. In a survey carried out by EPA in 1971, total coliform averaged 4,500 per 100 milliliter (ml) and fecal coliform, 140 per 100 ml, with ranges from 40,000 to 10,000,000 per 100 ml for total coliform and 700 to 890,000 per 100 ml for fecal coliform.

High coliform counts tend to occur during periods of low flow in the river. Late spring and summer tend to foster these high counts. Other enteric bacteria also have been encountered--Salmonella, Shigella, and Klebsiella. Thus, raw Ohio River water must be disinfected before any industrial or domestic use.

Three water quality standards applicable to the Ohio River and streams in Kentucky that are most relevant to power plant siting are temperature, dissolved solid concentrations, and pH. These standards are defined in detail in Appendix D, Table 8. First, depending on the temperature and quantity of discharged water and the flow in the receiving streams, the temperature rise is likely to be the limiting criterion for discharges to the Ohio River. The maximum-allowable-temperature criterion is likely to control discharge to tributary streams. Final determination for each individual site would be made using monthly stream-temperature data.

Second, depending on the quantity and dissolved-solids concentration of discharged waters, it appears that meeting the dissolved-solids-concentration criteria in the Ohio, Kentucky, and Green Rivers will be no problem. However, because of the extreme low-flow conditions in smaller tributaries, total plant discharges probably cannot be accepted in the smaller tributaries.

Third, considering the alkaline conditions of the surface streams in the study region, indicated by the high pH values, the difficulty or ease of meeting the hydrogen-ion criteria will depend on the anticipated alkalinity or acidity of plant discharges. Depending on the characteristics of the fuel to be consumed by the proposed plant, the untreated discharges from the plant may be alkaline or acidic. If alkaline discharges are anticipated, neutralization facilities are likely to be required in order to meet the pH criteria. However, if acidic discharges are anticipated, such neutralization facilities may not be required.

2.3.4 Water Use

Ground Water

Though the most predominant water source in the service area is from surface water, significant quantities of ground water are being withdrawn from counties bordering on the Ohio River. Greatest use is in Jefferson County, particularly for the city of Louisville. Individual industries in the county withdrew 24.2 million gallons per day (mgd) from sand and gravel aquifers in 1968 (Mull et al., 1971). In two other counties, Meade and Oldham, nearly all water supplies are derived from ground water aquifers; in Hardin County, about 75 percent of the water used is ground water.

Surface Water

Surface streams in the service area are used for urban/industrial and agricultural supply, navigation, and recreation. The main source for urban use is the Ohio River, particularly for the city of Louisville; in 1968, the Louisville Water Company withdrew an average of 114.6 million gallons per day from the Ohio, of which 62.3 mgd was for public supply and 52.3 mgd for industrial supply. Individual industries withdrew an additional 76.5 mgd from the Ohio River in that same year (Mull et al., 1971). Many of the smaller streams in the service area provide supplies adequate for agricultural use--watering domestic stock and some irrigation.

The major rivers in the study region are used extensively for navigation. The McAlpine Dam, placed in operation in 1961, provides a normal pool at elevation 420 feet (msl) for navigation upstream on the Ohio River beyond the service area. A navigation pool at elevation 383 feet (msl) is provided downstream from Louisville by Cannelton Lock and Dam, which began operation in 1966. These facilities provide a minimum navigation channel of 9-foot depth.

Navigation facilities on the Kentucky River provide a minimum navigable depth of 6 feet throughout the project. A Green River navigation system is connected directly with the Ohio River navigation project and provides slackwater navigation of 5.5 feet depth on the Green River from the mouth to Mammoth Cave, about 198 miles.

Since navigation is important on the streams in the service area, reservoirs on them for power plant water supply are unlikely to be approved. Also, any water withdrawal from these streams will require a permit from the U.S. Army Corps of Engineers.

Taylorsville Lake, a large reservoir currently under construction on the Salt River in the southeastern part of the service area, will be used for flood control, low flow regulation, and recreation. The summer recreation pool will cover 3,050 acres and will contain 86,400 acre-feet of water. Additional surface water recreation, primarily pleasure-boating, is provided by the Ohio River.

A tabulation of public and industrial water consumption in the service area is provided in Appendix E.

2.3.5 Aquatic Flora

The emergent plants include the cat-tail, arrowhead, sedges, smartweeds, and horsetails. Extensive stands of water willow are present in many tributaries to the Ohio River. Because of its frequent flooding and fluctuating water levels, however, the Ohio River is inhospitable to rooted aquatic plants.

2.3.6 Aquatic Fauna

Among the aquatic animals of the region, including the Ohio River and its tributaries, are many kinds of invertebrates such as zooplankters, flatworms, leeches, oligochaetes, isopods, amphipods, crayfishes, and a wide variety of insect larvae that include mayflies, stoneflies, dragonflies, damselflies, beetles, and true flies. In addition, there is a diverse population of snails and clams in suitable habitats in all the streams.

More than 74 species of fishes are known from the area, but the great majority are either forage or rough fishes, including many species of minnows, suckers, gizzard shad, and some catfishes. The channel catfish probably is the most abundant and desirable food fish in the Ohio River. Many of the sunfishes, particularly the largemouth bass, spotted bass, bluegill, and longear sunfish are common in the tributaries and to some extent in the Ohio River. These are the most sought-after game and pan fishes.

2.3.7 Significant Aquatic Habitats

There are few aquatic habitats within the Applicant's service area that could be construed as "significant." There are no high quality fishing streams in the regional service area. A small number of impoundments are scattered throughout the service area; these are listed below.

Lakes and Ponds in Regional Service Area

County	
Jefferson	Tom Wallace Lake, Caperton Swamp
Meade	Doe Valley Lake
Hardin	Stephensburg Lake, Freeman Lake, Valley Creek Reservoir
Henry	Jericho Lake
Bullitt	Duck Lake, Wilcox Lake, Froman Lake, Bill's Lake, Lake Elmo, Bennet Lake, Everbach Lake
Oldham	Reformatory Lake, Crystal Lake, Harmony Lake, Lake Louisa, Long Run Park Lake
Shelby	Guist Creek Lake, Shelby Lake, Cedarmore Lake, Trailwood Lake
Spencer	Taylorsville Lake (under construction)

2.4 DEMOGRAPHY

2.4.1 Existing Population and Density

Total population in the Applicant's service area reached 863,795 in 1970. Estimates for 1974 projected this figure to 887,000 for the nine-county region. In 1970, the Louisville Standard Metropolitan Statistical Area accounted for 95 percent of the total regional population. Population density for the region averaged 328 people per square mile in 1970, a figure that climbed to 333 in 1974. The majority of this population, however, was concentrated in Louisville; Jefferson County had a population density of 1,883 people per square mile in 1970.

The population within the region ranged from a median age of 21.8 years in Hardin County to 33.3 in Henry County. The population in Jefferson County, primarily urban, achieved a median age in 1970 of 27.4 years. In addition to its youthful character, Jefferson County also had the largest percent of non-whites residing within the region. In 1970, non-whites accounted for 14 percent of the county population. Trimble County was low, with 0.02 percent of its total population classified as non-white.

2.4.2 Future Population

Population grew at the rate of 46 percent for the region from 1950 to 1974; Hardin, Jefferson, and Oldham Counties grew at this rate. Spencer County actually lost population over the same time period, and Bullitt County expanded to 31,600 by 1974, an increase of 178 percent from 1950 to 1974. Henry County held constant at 11,400 people, and Trimble County also remained stable. Although a growth of 46 percent was achieved in the region's counties, population dynamics suggest a considerable reapportioning of population within the region. Louisville dominates the dynamics, however, by virtue of its size.

2.5 ECONOMICS

2.5.1 Existing Economics

Unemployment within the Applicant's service area ranged from a low of 2.5 percent in Trimble County to 5.2 percent in Spencer County. Manufacturing accounted for a third of the income generated in the region. Over 86 percent of all manufacturing income originated in Louisville. Government accounted for 17 percent of the regional income followed by trade (16 percent) and services (12 percent). Farming accounted for only 1.6 percent of the total regional income.

2.5.2 Future Economics

Total income from 1969 to 1973 increased 39 percent for the service area, with an annual increase of 9.75 percent. The percentage changes in income for Bullitt and Henry Counties exceed this average by 12 and 14 percentage points, respectively. Income generated in Hardin County increased by 11 percent over the same time period. Future economic growth in the service area can be expected to continue at the same or a slightly reduced rate (see Section 1.0).

2.6 LAND USE

Power generation is an integral component of an area's economy and the way land is used. The need for electrical energy is dictated by the types of land use and the growth of energy-consuming industries and residential development. Yet the very elements of the economy that require power often compete for available land, water, and air resources. Power plant siting must acknowledge other "higher and better" economic land uses such as existing industrial, commercial, and residential use and also the value of irreplaceable land resources such as prime farmland, unique lands preserved for their scientific value or lands dedicated to public use, and lands supporting valuable historic and archaeological resources. The goal in siting power plants is to locate them where they will be compatible with existing land uses and where they will not preempt a future, better use of the land resource, nor destroy or make impossible the maintenance and/or recovery of important cultural and environmental qualities important to human welfare. Thus, the ideal is to site on lands that are marginal in their present use and where a power plant would therefore represent a "higher and better" use. Since the definition of such use is subject to change, the only approach that can usually be taken in siting power plants is to take into account the long range plans and planning objectives of local and regional governments and abide by existing land use zoning regulations.

2.6.1 Existing Land Use

Agricultural

Approximately 73 percent of the total acreage within the Applicant's service area was devoted to farms in 1969 (Figure 2.6.1-1). Major farming counties in 1969 included Henry, Oldham, Shelby, Spencer, and Trimble. In each of these counties, 90 percent or more of the land was classed as farmland. Jefferson County had the least farmland (37 percent). Actual cropland totaled 746,671 acres in 1969, or 44 percent of the total service area acreage. Woodland, including woodland pasture, accounted for 14 percent of the regional land use.

Industrial

Within the Applicant's service area, the major concentration of industrial activity is along the river front of Louisville (Figure 2.6.1-1). Other smaller industrial areas are located near LaGrange, Shelbyville, and Taylorsville east of Louisville in the service area (Kentuckiana Regional Planning and Development Agency, 1973). South of Louisville, near Shepherdsville, industry is light and scattered over the area. In addition, there are scattered industries south of Louisville along Interstate 65 in Bullitt County. Within Meade County, major industrial activities are located along the Ohio River.

Other power plants within the Applicant's service area include several facilities operated by the Applicant. The Applicant's facilities are located as follows:

Mill Creek Plant	River Mile 626
Cane Run Plant	River Mile 617
Paddy's Run Plant	River Mile 613
Downtown Louisville Plants	River Miles 606 and 604

All of these facilities are located in Jefferson County. Another generating facility, across the Ohio River from the Applicant's service area, is Public Service Company's Gallagher plant at River Mile 610. In addition, the Indiana-Kentucky Power Corporation has a plant at Clifty Creek near Madison, Indiana. Ghent Power Plant is located just north of Ghent, Kentucky in Carroll County at River Mile 536. Table 2.6.1-1 lists existing and proposed plants within the area of interest.

Residential

Residential land uses are scattered throughout the Applicant's service area; they are centered in small towns, along state and county roads, and especially in Louisville (Figure 2.6.1-1).

To the east of Louisville, the larger residential towns include LaGrange, Eminence, Shelbyville, and a sizable area just west of Floydsburg. South of Louisville, Taylorsville, Mount Washington, Shepherdsville, Lebanon Junction, Elizabethtown, and Hardinsburg are the major towns.

The heaviest geographical concentration of residential land use is on the immediate fringe of Louisville, especially to the east and south.

Commercial

Outside of Louisville, commercial land uses are restricted to towns in the Applicant's service area (Figure 2.6.1-1). North of Louisville in Oldham County, land is in commercial use near Floydsburg at the intersection of Kentucky Routes 146 and 22, at Brownsboro, at Buckner and especially at LaGrange. Other commercial land use is along U.S. 42 and at Harmony Village and Westport.

To the northeast in Henry County, land is in commercial use in Campbellsburg and Port Royal. New Castle, Eminence, Pleasureville, and Smithfield in the central and southern part of the county are locations of commercial land use. In the eastern part of the county, commercial activity centers in Lockport and Defoe.

East of Louisville, major concentrations of commercial land use exist in Shelbyville and Simpsonville and along U.S. 60. Taylorsville, in Spencer County, is also a major commercial center.

TABLE 2.6.1-1

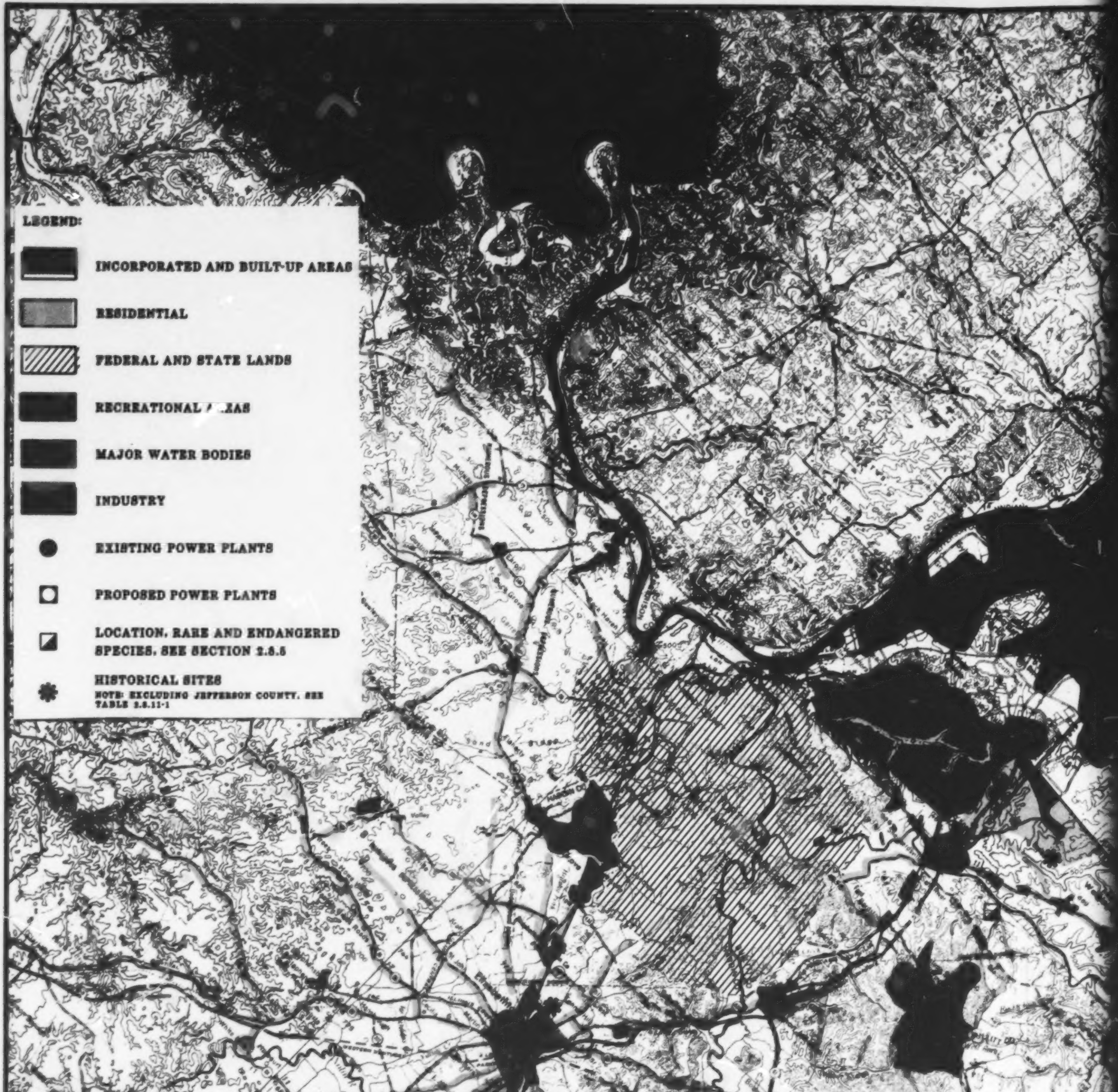
EXISTING AND PROPOSED POWER PLANTS ALONG THE OHIO RIVER, RIVER MILE 535 TO 689

Name	Fuel	Location	Owner	Status
Ghent	Coal	Carroll County, Kentucky (River Mile 536.0)	Kentucky Utilities	In operation (one additional unit under construction; another unit proposed)
-	-	Carroll County, Kentucky (River Mile 555.0)	American Electric & Power	Potential site
Clifty Creek	Coal	Jefferson County, Indiana (River Mile 560.0)	Indiana-Kentucky Power Corp.	In operation
Marble Hill	Nuclear	Jefferson County, Indiana (River Mile 570.0)	Public Service Indiana	Proposed
Trimble County	Coal	Trimble County, Kentucky (River Mile 572.0)	Louisville Gas & Electric Co.	Proposed
Waterside	Gas turbine	Jefferson County, Kentucky (River Mile 603.8)	Louisville Gas & Electric Co.	In operation
McAlpine	Hydro	Jefferson County, Kentucky (River Mile 605.9)	Louisville Gas & Electric Co.	In operation
Gallagher	Coal	Floyd County, Indiana (River Mile 610.0)	Public Service Indiana	In operation
Paddy's Run	Coal	Jefferson County, Kentucky (River Mile 613.6)	Louisville Gas & Electric Co.	In operation

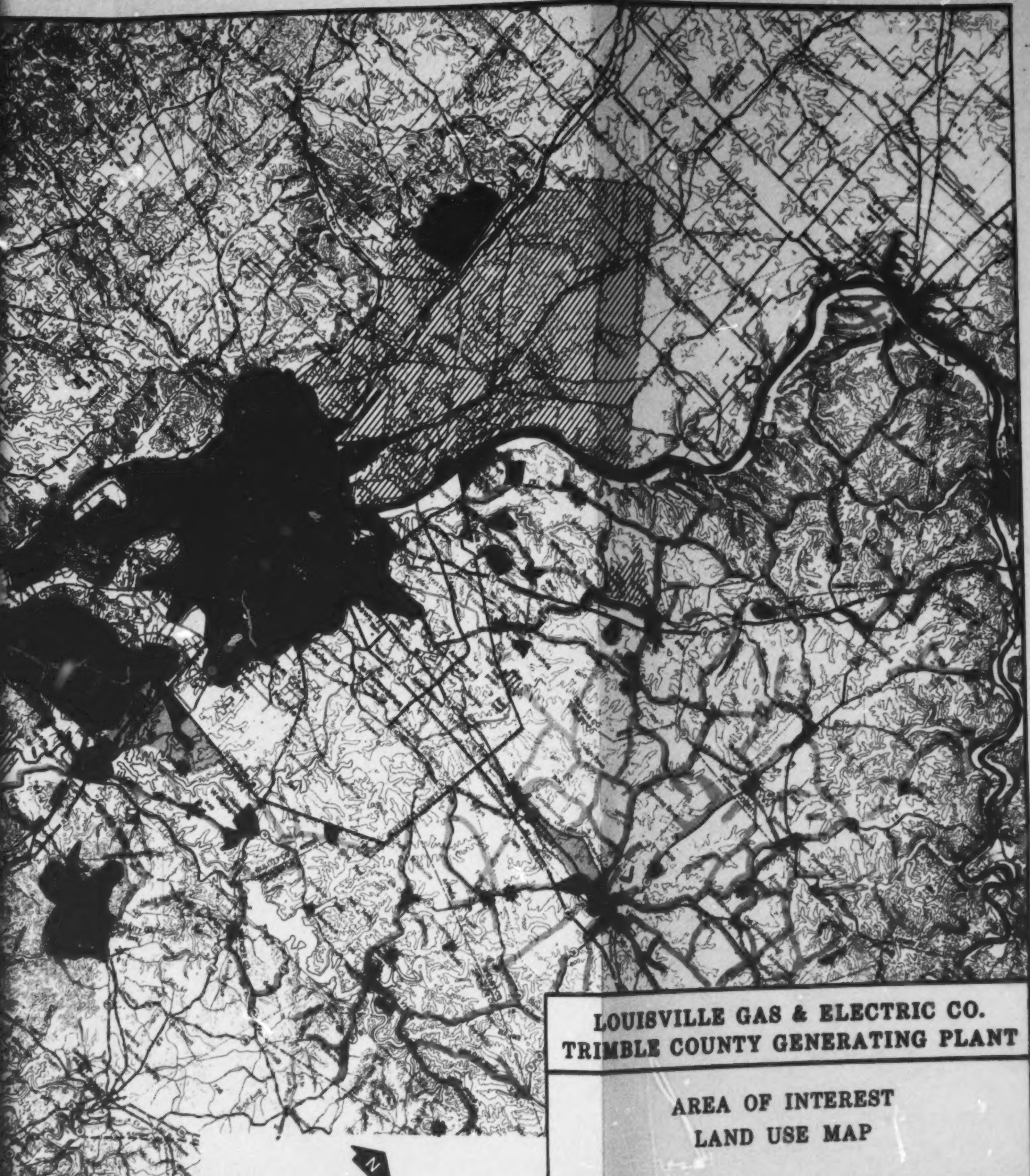
TABLE 2.6.1-1 (Continued)

Name	Fuel	Location	Owner	Status
Cane Run	Coal	Jefferson County, Kentucky (River Mile 616.8)	Louisville Gas & Electric Co.	In operation
Mill Creek	Coal	Jefferson County, Kentucky (River Mile 626.0)	Louisville Gas & Electric Co.	In operation (one additional unit under construction; another unit proposed)

Source: Ohio River Valley Water Sanitation Commission, 1975, Thermal discharges to the Ohio River: an evaluation of river temperature relationships, 1964-1974


LEGEND:
INCORPORATED AND BUILT-UP AREAS
RESIDENTIAL
FEDERAL AND STATE LANDS
RECREATIONAL AREAS
MAJOR WATER BODIES
INDUSTRY
● EXISTING POWER PLANTS
○ PROPOSED POWER PLANTS
◪ LOCATION, RARE AND ENDANGERED SPECIES, SEE SECTION 2.8.5
✱ HISTORICAL SITES
NOTE: EXCLUDING JEFFERSON COUNTY, SEE TABLE 2.8.11-1

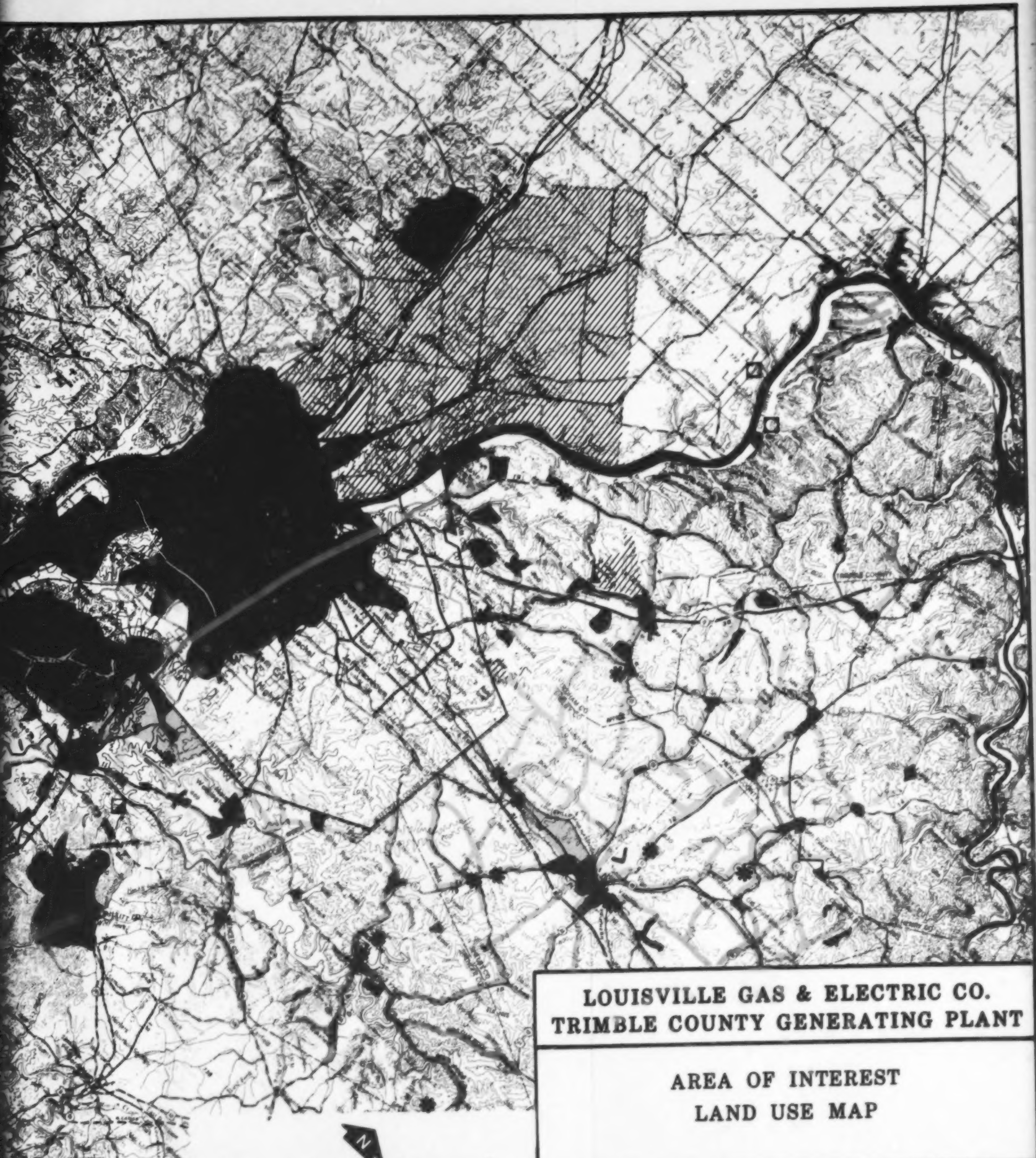
SOURCE OF TOPOGRAPHY: USGS 1:250,000 SCALE MAPS—EVANSVILLE, 1957; LOUISVILLE, 1956; VINCENNES, 1956-66; WINCHESTER, 1957.


N
0
5
10
SCALE IN MILES

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

AREA OF INTEREST
LAND USE MAP

FIGURE 2.6.1-1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SCALE IN MILES
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LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

AREA OF INTEREST
LAND USE MAP

FIGURE 2.6.1-1

South of Louisville, Shepherdsville, Mount Washington, and Lebanon Junction have major areas of commercial land use. Commercial land use is also spotted along Kentucky Route 44 between Mount Washington and Shepherdsville, and along I-65 between Shepherdsville and Lebanon Junction.

South and west of Louisville, commercial land use is concentrated in Elizabethtown, Fort Knox, Muldraugh, Radcliff, and Vine Grove. Other smaller commercial activites exist in Sonora, Upton, and Stephensburg in the southern part of Hardin County and Brandenburg in Meade County.

2.6.2 Future Land Use

Agricultural

Farm acres dropped two percentage points from 1964 to 1969 within the Applicant's service area. The largest decrease occurred in Bullitt and Jefferson Counties (-9 and -7 percent, respectively). Spencer County recorded an increase in farm acres, though a very small (0.2) percentage. Total farm acreage from 1967 to 1969 dropped from 74.3 percent of total land area in the region to 73 percent. Although cropland increased 2 percent from 1964 to 1969, harvested cropland decreased 13 percent. The overall increase in cropland was due to a 10 percent increase in pasture cropland. Woodlands, including woodland pasture, decreased 13 percent from 1964 to 1969 for the service area. Though farmland dominated the land use patterns in the service area in both 1964 and 1969, there is a definite decreasing trend in farmland acreage.

Industrial

Future land use patterns within the Applicant's service area should follow a distribution similar to that presently existing (Kentuckiana Regional Planning and Development Agency, 1973). East of Louisville, scattered concentrations of industrial activity are projected just northeast of LaGrange centering on Kentucky Route 146. Other industrial concentrations are projected near Buckner in Oldham County near the interchange of I-71 and Kentucky Route 146, and on Zaring Road.

East of Louisville, in Shelby County, industry is projected for Shelbyville south of town on Kentucky Route 53 and southeast of town along County Route 2257. Industry is also projected south of Simpsonville along County Route 1848 and south of I-64 on County Road 1848. An isolated industrial area is also projected south of Southville on Kentucky Route 53 near its intersection with Netherley Road.

Southeast of Jefferson County in Spencer County, small industrial activities are projected near Wilsonville on Kentucky Route 155 and near Elk Creek on Kentucky Route 55. Both of these centers are near Jefferson County.

South of Louisville, industrial activities are projected near Shepherdsville at the intersection of I-65 and Kentucky Route 44. Smaller industrial activities are projected southwest of town out County Road 1494 and south of town along the Louisville & Nashville Railroad. Other major industrial concentrations are projected near Clermont along Kentucky Route 245 and farther south in Lebanon Junction. A small amount of industrial activity is also projected east of Clermont on County Road 1604.

To the west and southwest of Louisville, industry will be located along the Ohio River in Meade County and near Elizabethtown in Hardin County.

A nuclear power plant is proposed near Marble Hill, Indiana and a potential plant site has been identified in Carroll County, Kentucky (see Table 2.6.1-1).

Residential

Projected residential land uses within the Applicant's service area show a heavy spread east from Louisville and corridor developments along major transport arterials primarily to the north.

High density residential land use is projected to extend a considerable distance (12 miles) east of the existing high density area of Louisville. The spearhead of growth centers on I-64 through Jefferson County. The northeast and south extensions of this high density residential area are projected to reach only 4 or 5 miles from the existing high density residential area. A residential ring approximately a mile wide and of lower density is projected to encircle the high density residential area of Louisville.

Major corridors of residential development reaching out from the core of Louisville include two major areas to the northeast along I-71 to Jericho Lake and along U.S. 42 to its intersection with Kentucky Route 393. Secondary corridors stem out from the I-71 corridor at LaGrange, extending north-south along Kentucky Route 53 and north-south along Kentucky Route 153 near Jericho Lake.

To the immediate east of Jefferson County, another corridor of residential land use extends along U.S. 60 through Shelby County. A loop stretches south along Kentucky Route 53 from Shelbyville to Southville, along Kentucky Route 44 to Taylorsville, winding northwest along Kentucky Routes 55 and 155 through Wilsonville to Jefferson County.

A third residential land use corridor is projected along I-65 to Shepherdsville. From Shepherdsville, a corridor loops back to Jefferson County along Kentucky Route 44. A small area also reaches eastward from Shepherdsville along Kentucky Route 480.

In addition to the above corridor development projected within the Applicant's service area, there are also several large isolated clusters of residential land use in the area. North of Louisville, Milton and Bedford in Trimble County provide a nucleus for residential land use clusters. From I-71 to Campbellsburg is another elongated cluster. To the east of Louisville, a small isoloated corridor of residential land use is projected between New Castle and Eminence. A second cluster focuses upon Pleasureville. To the south of Louisville, residential land use is centered upon Clermont and Lebanon Junction.

West and south of Louisville, residential land use is presently interrupted by the Fort Knox Military Reservation, separating Meade and Hardin Counties from the Louisville Standard Metropolitan Statistical Area. Elizabethtown will form the major nucleus of residential land use within Hardin County. Smaller clusters will be centered upon Fort Knox, Vine Grove and Radcliff in the northern portion of the county immediately south of the military reservation. In the southern part of the county, Sonora and Upton will provide centers for separate residential clusters. Stephensburg, located in the central part of Hardin County along U.S. 62, also will provide a core for residential land use. Within Meade County, the major residential land use will be concentrated in Brandenburg and a minor one in the eastern part of the county at Muldraugh.

Commercial

Outside the commercial land use that will develop within Jefferson County, several outlying commercial centers are projected in surrounding towns.

To the north, major areas of commercial land use are projected at Buckner, LaGrange, Ballardsville, Pendleton, Sligo, and Campbellsburg along the I-71 corridor. Along the U.S. 42 corridor, major commercial centers are projected at the intersection of 42 with Kentucky Route 1793 and at Skylight. Other commercial centers are projected at Milton, Bedford, New Castle, Eminence, and Pleasureville.

East of Louisville, major commercial centers are projected at Simpsonville, Shelbyville, Clay Village, Peytona, Taylorsville, and Southville. Smaller centers are projected at Wilsonville, Elk Creek, and Finchville.

South of Louisville, major commercial centers are projected for Shepherdsville, Mount Washington, Clermont, Maryville, and Lebanon Junction.

West and south of Louisville, the major commercial land uses will be at Elizabethtown, Fort Knox, and Vine Grove. Other commercial centers will continue to develop at Sonora, Upton, and Stephensburg in the southern part of Hardin County and at Brandenburg in Meade County.

2.7 TRANSPORTATION

The Applicant's service area is served by national rail lines; the Ohio and Kentucky Rivers; interstate, state, and county road networks; and scheduled air service. The Commonwealth of Kentucky comprises part of District No. 41, U.S. Bureau of Customs, which has district headquarters in Cleveland, Ohio. Louisville is the port of entry and collections for Kentucky.

Major transport systems focus upon Louisville, the largest metropolitan area in the Applicant's service region.

2.7.1 Railroads

As of December 31, 1972, there were four Class I railroads operating in the Applicant's service area. The Louisville & Nashville Railroad has a line connecting Louisville to Owensboro to the west, Bowling Green to the south, Lexington to the east, and Cincinnati to the northeast. In addition, a line connects Louisville to Chicago.

The Chesapeake and Ohio Railroad, a part of the Chessie System, connects Louisville, through Shelbyville and Frankfort, to Lexington. A line of the Baltimore & Ohio (Chessie System) and Penn Central connects Louisville to Cincinnati via its St. Louis-Cincinnati connection.

Southern Railroad connects Louisville to Lexington through Shelbyville, and to St. Louis through southern Indiana and Illinois.

Illinois Central Gulf Railroad connects Louisville, via West Point and the Kentucky Parkway route, to Paducah.

2.7.2 Waterways

The Ohio River presently has a 9-foot navigation channel for its entire length along Kentucky, with a minimum channel width of 300 feet. The Applicant's service area lies adjacent to two primary pools on the Ohio River: (1) Cannelton, with a pool elevation of 383 feet, and (2) McAlpine, with a pool elevation of 420 feet.

Traffic (in tons) on the Ohio River grew at the annual rate of 4.4 percent from 1950 to 1964. Ton miles grew at an annual rate of 8.2 percent over the same time period. Coal and coke are, by far, the largest volume product (by tons) transported on the river, followed by petroleum products, stone/sand/gravel, chemicals/sulfur, and iron and steel (U.S. Army, n.d.). Tonnage at Cannelton Locks increased from about 800,000 tons in 1930 to 27.7 million tons by 1964. Tonnage at McAlpine Locks grew from about 900,000 tons to 26.4 million tons over the same period (U.S. Army, n.d.).

Privately owned public ports within the Applicant's service area are located at Louisville. The Kentucky Port and River Development Commission, authorized in 1966, promotes river commerce and water-oriented industry.

In addition, a local riverport authority has been formed in Louisville (other such authorities exist on the Ohio River outside the Applicant's service area).

Over 100 barge lines provide service on Kentucky's navigable waterways. Most of these companies specialize in moving dry and liquid bulk cargoes, and most of them ship on the Ohio River.

The Kentucky River joins the Ohio River just west of Carrollton, Kentucky. A 6-foot navigation channel is maintained throughout the Kentucky River system, with a 9-foot channel up river to about 5 miles from its mouth on the Ohio River. Traffic on the river reached a low point in 1951 with 66,000 tons of commodity transported (U.S. Army, n.d.). From 1952 to 1964, downbound shipments of coal helped reverse a decreasing trend in river traffic; however, in 1964, transport of coal on the river was discontinued, once again causing a decrease in traffic (U.S. Army, n.d.).

Traffic on the Kentucky River presently consists mainly of private recreational craft.

2.7.3 Highways

The highway system within the Applicant's service area is dominated by a series of interstate and state highways radiating out from Louisville. Interstate 264 encircles the city; I-71 connects Louisville to Cincinnati; I-64 connects to Frankfort; and I-65 (Kentucky Turnpike) connects to Nashville and, via the Western Kentucky Turnpike at Elizabethtown, to Paducah.

Louisville, together with Cincinnati, provides the major entrepôt for Kentucky. Five other key interchange points are located within the state (Lexington, Paducah, Huntington-Ashland, Henderson, and Bowling Green).

2.8 SENSITIVE AREAS

2.8.1 Sensitive Geologic Areas

The significant consequences of industrial siting on the various strata discussed in Section 2.2.2 are evaluated below.

The significant environmental consequences of siting a power plant on Silurian strata would be:

1. Possible loss of foundation support due to sinkhole development in the karstic topography
2. The likelihood of ground water contamination from chemical stockpiles and waste disposal on complex karstic aquifers

Ordovician strata offer virtually no environmental limitations of major consequence. However, weathered colluvium at a steep outcrop may be landslide-prone if the shale content is especially high.

Weathered shale at an outcrop slope of Upper Devonian strata may be conducive to colluvial landsliding where rapid stream erosion has oversteepened natural slopes. The clayey residual soil that forms on the Upper Devonian shale would be very impermeable and would generally protect the ground water environment against the likelihood of percolating contamination. Foundations would have to be designed to contend with problems associated with residual clay soils.

The environmental behavior of Lower and Middle Devonian strata would be nearly the same as for the Silurian strata.

Problems of foundation support and ground water contamination in Mississipian strata are similar but more severe than those described for Silurian strata because there is very little shale strata in the sequence to interrupt sinkhole development. Hidden beneath a cover of residual soil, the bedrock surface is extremely rough. The relief between bedrock "pinnacles and cutters" is often on the order of 20 feet or more. Limestone "float blocks" sometimes appear as bedrock until deeper drilling reveals that large blocks of rock are "floating" in residual soil and have been completely detached from the actual bedrock mass by chemical solution activity. The "red clay" residual soil is somewhat more permeable relative to most clay soil types and is difficult to work with in constructing structural fills and embankments because of its poor compaction characteristics.

No environmental limitations exist because of the Jeptha Knob structure except for the remote possibility of a plant siting right on the knob.

Seismicity of the area is low and presents no particular siting problem. However, moving the plant site towards the southwest end of the service area would bring it closer to the Rough Creek fault zone and the active New Madrid fault zone. However, this would have a very small effect on the seismic intensity that a given plant location would be likely to undergo.

Deposits of glacial till and loess are usually so thin in Kentucky that they can be disregarded in environmental impact planning.

2.8.2 Steeply Sloping Lands

The Highland Rim region to the south and west of Louisville, known locally as "the Knobs," is a section of the service area that would be "sensitized" by development. This area contains steep slopes that are sensitive to erosion, slumping, and sedimentation through runoff.

2.8.3 Forest and Woodland

The Fort Knox Military Reservation occupies parts of Bullitt, Hardin, and Meade Counties and serves as an armored training facility. The forested areas of the Reservation provide good wildlife habitat for native species of mammals, birds, reptiles, and amphibians. In the past, short deer hunting seasons have been permitted on the Reservation, but this may be terminated now.

The Jefferson County Forest in southern Jefferson County is 1,771 acres of second-growth timber, primarily oak-hickory, but with poplar and walnut fairly common in low areas.

Lumbering would not be infringed upon by development, since it is not currently practiced commercially in the service area.

2.8.4 Prime Agricultural Lands

In 1972, tobacco accounted for 50 percent of the total value of crop production, followed by corn (20.9 percent), soybeans (12.9 percent), hays (12.4 percent), and small grains (2.5 percent).

Of the nine counties in the Applicant's service area, only Shelby and Henry Counties ranked in the top 10 counties in the state for burley tobacco production in 1972. These counties did not rank in the top 10 counties in the state for production of any other major crops.

Hardin County ranked eighth in corn production in the state, fifth in barley production, and fifth in alfalfa hay. Meade was ninth in barley production; Oldham was tenth in alfalfa hay production (Shelby was first); and Shelby was fourth in clo-tim hay.

In 1971, approximately half (57 percent) of gross farm income in Kentucky was contributed by livestock and products (U.S. Department of Agriculture, 1973). On January 1, 1973, Shelby County ranked as the third largest producer of cattle and calves (Hardin County was tenth). Shelby County was also the eighth largest producer of sheep and lambs, and was first in milk production in 1973 and 1971, respectively. Spencer and Henry Counties ranked fourth and sixth, respectively, in milk production for 1971.

Of those counties in the Applicant's service area, Shelby contains what is by far the prime agricultural land. Hardin is important because of its corn production and its role as a livestock center. Henry is significant in that it is a major producer of burley tobacco, a product that generated $271,234,000 in cash receipts in 1971.

2.8.5 Habitats of Rare and Endangered Species

The following species appear on a "Preliminary List of Rare and Endangered Species in Kentucky," which was prepared by an *ad hoc* committee of the Kentucky Academy of Science. While some species are uncommon or rarely collected, a number of species have a rather wide range in eastern North America. Although these species may be rare in Kentucky, many are probably not in danger of extinction.

List of Apparently Rare and Endangered Species in the Applicant's Service Area

Fishes

Trout-perch	*Percopsis omiscomaycus*
Channel darter	*Percina copelandi*
Slenderhead darter	*Percina phoxocephala*
River darter	*Percina shumardi*
Tippecanoe darter	*Etheostoma tippecanoe*

Amphibians

Western lesser siren	*Siren intermedia*
Mole salamander	*Ambystoma talpoideum*
Red-backed salamander	*Plethodon cinereus*
Four-toed salamander	*Hemidactylium scutatum*
Green treefrog	*Hyla cinerea*

Reptiles

Kirtland's water snake	*Clonophis kirtlandi*
Eastern ribbon snake	*Thamnophis sauritus sauritus*

Reptiles, Continued

Scarlet snake	*Cemophora coccinea*
Southeastern crowned snake	*Tantilla coronata coronata*

Birds

Northern bald eagle	*Haliaeetus alascanus*
Osprey	*Pandion haliaetus*
Golden eagle	*Aquila chrysaetos*

Mammals

Bachman's shrew	*Sorex longirostris*
Gray bat	*Myotis grisescens*
Indiana bat	*Myotis sodalis*
Cloudland deermouse	*Peromyscus maniculatus nubiterrae*
Bobcat	*Lynx rufus*

Plants

Purple fringeless orchid	*Platanthera peramoena* (Gray)
Cruciferae	*Leavenworthia exigua* var. *laciniata* (Rollins)
Goldenrod	*Solidago shortii* Torr. & Gray

The type locality of *Leavenworthia exigua* var. *laciniata* is 6 miles east of Shepherdsville, Kentucky on Ridge Road, 2 miles north of KY-480, Bullitt County. The type locality of the goldenrod is Rock Island, Falls of the Ohio.

There are no other specific localities within the service area for any of the other rare and endangered species listed.

2.8.6 Marshlands, Wetlands

Caperton Swamp, an area along the Ohio River in eastern Jefferson County, has been for many years a scenic natural area. However, the marsh has been greatly reduced by development in recent years. Interstate Highway 71 effectively divided the marsh and increased drainage of the area. Prior to this highway development, this was the only sizable wetlands area in the service area that had not been greatly reduced or destroyed.

2.8.7 Flood Plains or Flood Retention Areas

The streams of the service area all have flood plains of varying sizes. The flood plain of the Ohio River is perhaps the only area where development can be carried out successfully. The city of Louisville is protected by a flood wall that is being extended to protect southwestern Jefferson County and permit further development and growth. None of these areas will be rendered "sensitive" by more development.

2.8.8 Surface Waters

The reach of the Ohio River in southwestern Jefferson County below McAlpine Dam, from River Mile 607 to River Mile 630, carries a heavy load of industrial wastewater and domestic sewage treatment effluent. Although it is heavily industrialized now, further development in the reach is planned. This probably makes this area a little more sensitive to development than other areas of the flood plain, either upstream or downstream on the Ohio River.

2.8.9 Ground Water Recharge Along the Ohio River Flood Plain[1]

Ground water reserves along the Ohio River flood plain are recharged from three principal sources: precipitation, leakage from bedrock at the valley wall, and stream bed infiltration from the Ohio River. Under normal pool stage conditions of the Ohio River and without the drawdown effects of wells, the natural flow of ground water is toward the river. The recharge allowing this flow gradient to occur is caused by the direct infiltration of precipitation and also by subsurface flow through bedrock that subcrops at the valley wall. The combined effects of direct precipitation and bedrock leakage account for a naturally occurring recharge rate of about 0.4 million gallons per day (mgd) per square mile of flood plain. This typical recharge rate is equivalent to a continuous yield of about 300 gallons per minute (gpm) from wells that tap the aquifer at a rate of one per square mile. The contribution from precipitation is estimated to range from 0.3 mgd to 0.5 mgd per square mile. Less than 0.2 mgd per square mile of aquifer is attributed to leakage along the valley wall.

Along the Ohio River, the hydraulic connection with the glacial-fluvial aquifer ranges from poor to excellent, depending upon the thickness of silt and clay along the river bottom. Where the hydraulic connection is good, the aquifer gains seasonal recharge during flood stages of the Ohio River. During flood stage, the ground water flow gradient may be temporarily reversed, particularly near the edge of the river.

[1] The principal reference for material in this section is Whitesides and Ryder, 1969.

High capacity water wells, yielding 1,000 gpm or more, are often placed as close to the river as possible where the hydraulic communication is good. The high yield of such wells is possible where induced stream bed infiltration can be utilized to prevent an overdraft from the aquifer.

2.8.10 Public Outdoor Recreation Areas

Existing

Besides Fort Knox Military Reservation and Bernheim Forest, both located south of Louisville, there are few major public or semi-public lands within the Applicant's service area. In addition to the Jefferson County Forest (see Section 2.8.3), which is used for public recreation, Otter Creek Park, 30 miles southwest of Louisville, is a heavily used public recreation area. Otter Creek park is a 2,427-acre preserve that was set aside in 1939 by the National Park Service as a reforestation area and wildlife sanctuary. The park is adjacent to the Fort Knox Military Reservation, but the city of Louisville manages the park and supervises maintenance and upkeep. Recreational facilities will be developed in Spencer County at Taylorsville Lake, a multipurpose reservoir currently under construction by the U.S. Army Corps of Engineers.

To the north of Louisville, there are scattered small plots of public and semi-public lands with some concentrations near Bedford, Milton, Campbellsburg, New Castle, Eminence, Pleasureville, Brownsboro, and Floydsburg.

The Kentucky Department of Parks lists one natural wildlife area just west of Brownsboro (University of Louisville's Horner Bird and Wildlife Sanctuary) and two recreational areas (Camp Kavanaugh Boys Camp and Covered Bridge Boy Scout Reservation) on Kavanaugh Lane and off Kentucky Route 329 on Harrods Creek, respectively. The Department of Parks lists one recreation area within Henry County--the Little Kentucky River Sportsman's Club, located near the town of Sulphur just off I-71.

Two recreation areas are located in Shelby County. Guist Creek Lake, with 304 acres of water, is located just east of Shelbyville. Armstrong's Shooting Preserve is located off Kentucky Route 1922 in the northeastern part of the county.

To the southwest and south of Louisville, the two counties of Spencer and Bullitt have two natural areas and three recreation areas. A fish and wildlife shooting preserve is also located within the county (Rainle's Preserve). The Spencer County Fish and Game Camp is located just east of Taylorsville. Bernheim Forest is located in the southeastern part of Bullitt County off Kentucky Route 245. Camp Shantituck is located in the north central part of Bullitt County off Hebron Lane Road. The Fort Knox Hunting Area is located in the western part of the county.

There are two natural areas and four recreational areas within Hardin County. Two trails, Lincoln Trail Hike and Severus Valley Trails, provide a combined mileage of 62 miles of historical and native hiking in the county. Recreational facilities in the county include the Elizabethtown Optimist Youth Camp (north of Elizabethtown and west of I-65); Rough Creek (off Kentucky Route 220 and 920 northwest of Elizabethtown); Fort Knox Hunting Area; and Freeman Lake (north of Elizabethtown).

Meade County has one natural area (Ohio River Trails) and two recreational areas. Doe Valley Lake and Park is located 5 miles east of Brandenburg on Kentucky Route 933, and Otter Creek Park is located in the eastern part of Meade County off Kentucky Route 1638.

Future

The largest proposed public and semi-public land uses within the service area for the future are projected to be Bernheim Forest and Fort Knox Military Reservation. Other large facilities are projected at Guist Creek Lake, Taylorsville, and Pee Wee Valley. Medium-sized recreational areas are projected at Milton, Bedford, LaGrange, and Buckner to the north of Louisville. To the north and east of Louisville are projected several medium recreation land areas (New Castle, Smithfield, Eminence, and Pleasureville). East and south of Louisville, medium-sized recreational areas are projected near Taylorsville, Mount Washington, Shepherdsville, Cedar Grove, Lebanon Junction, and Elizabethtown. Small recreational lands are projected throughout the Applicant's service area.

2.8.11 Archaeological and Historic Sites

Table 2.8.11-1 lists places within the Applicant's service area that have been entered in the National Register of Historic Places, as well as archaeological sites on file with the state archaeologist.

TABLE 2.8.11-1

ARCHAEOLOGICAL[a] AND HISTORIC[b] SITES IN THE APPLICANT'S SERVICE AREA

Bullitt County

Archaeological Sites

Near Knob Creek - 15 Bu 51, 15 Bu 52, 15 Bu 53, 15 Bu 54

West of Shepherdsville on the Salt River Flood Plain - 15 Bu 43, 15 Bu 44, 15 Bu 46, 15 Bu 47, 15 Bu 48, 15 Bu 49, and 3 additional unnumbered sites

Near Confluence of Floyd's Creek and the Salt River - 15 Bu 40, 15 Bu 41, 15 Bu 42, 15 Bu 84, 15 Bu 150, 15 Bu 151

Historic Sites

Shepherdsville vicinity, Ashworth Rock Shelters Site, North of Shepherdsville off U.S. 65 (9-11-75)

Hardin County

Archaeological Sites

East of White Mills - 15 Hd 11

Near Needham Cumberland Church - 15 Hd 8

North of Solway - 15 Hd 2

Northeast of New Union School - 15 Hd 9

Near Roaring Spring - 15 Hd 13

South of Howe Valley - 15 Hd 14

Howe Valley - 15 Hd 12, 15 Hd 15

Near Buzzard Cliff - 15 Hd 16

Near Laurel Ridge - 15 Hd 5

Near Pierce Mill - 15 Hd 7

Historic Sites

Elizabethtown, Brown Pusey House Community Center, 128 North Main Street (7-12-74)

Elizabethtown, First Baptist Church, 112 West Poplar Street (12-31-74)

Elizabethtown vicinity, Lincoln Heritage House, north of Elizabethtown near Freeman Lake (3-26-73)

Henry County

Archaeological Sites

Emily Run - 15 Hy 1

On Drennon Flood Plain - 15 Hy 3, 15 Hy 4

Historic Sites

None

Jefferson County

Archaeological Sites

Intersection of SR 44 and U.S. 60 - 15 Jf 248

Watson Lane on Ohio River Flood Plain - 15 Jf 19

Lower River Road - 15 Jf 243

Orell Road and Lower River Road - 15 Jf 240

Moorman and Lower River Road - 15 Jf 241, 15 Jf 242

Ohio River Flood Plain West of Lower River Road - 15 Jf 1, 15 Jf 5, 15 Jf 12, 15 Jf 13, 15 JF 14, 15 Jf 17

West Shuck Lane - 15 Jf 36

Ohio River Flood Plain West of Sylvania - 15 Jf 20, 15 Jf 21, 15 Jf 37

Near Lower Hunters Trace - 15 Jf 16

Near Slope Ditch and Preston Street - 15 Jf 39

Near Ashbottom Road and Grade Lane - 15 Jf 10

North of Bowman Airfield - 15 Jf 22, 15 Jf 23, 15 Jf 24, 15 Jf 25, 15 Jf 202

Beargrass Creek - 15 Jf 27, 15 Jf 28, 15 Jf 29, 15 Jf 30, 15 Jf 31, 15 Jf 32

Beargrass Creek - 15 Jf 33, 15 Jf 34, 15 Jf 38, 15 Jf 134

TABLE 2.8.11-1 (Continued)

In Jeffersontown - 15 Jf 9

Southeast of Wildwood - 1 unnumbered site

Near Western Cemetery - 15 Jf 35

Ohio River Flood Plain South of Sand Island - 15 Jf 3

East of Griffytown - 15 Jf 7

Historic Sites

Eastwood, Long Run Baptist Church and Cemetery, Long Run Road (8-6-75)

Louisville, Adath Israel Temple, 834 South 3rd Street (12-31-74)

Louisville, Belle of Louisville, Steamer, Carrie Gaulbert Cox Park, 3700 Upper River Road (4-10-72)

Louisville, Cherokee Triangle Area Residential District, roughly bounded by Bardstown Road, Sherwood Road, Broadway, east to junction of Grinstead Drive and Cherokee Parkway (6-30-76)

Louisville, Christ Church Cathedral, 421 South 2nd Street (8-14-73)

Louisville, Church of the Messiah (First Unitarian Church), 805 South 4th Street (4-21-76)

Louisville, Farmington, 3033 Bardstown Road (10-18-72)

Louisville, Hikes-Hunsinger House, 2834 Hikes Lane (10-10-75)

Louisville, Jefferson County Courthouse, 527 West Jefferson Street (4-10-72)

Louisville, Jefferson County Jail, 514 West Liberty Street (7-16-73)

Louisville, Kentucky Air National Guard Archaeological Site, Standiford Field, at the north end of Grade Lane (9-12-72)[c]

Louisville, L&N Steam Locomotive #152, 1837 East River Road (12-30-74)

Louisville, Landward House, 1385-1387 South 4th Street (9-20-73)

Louisville, Little Loomhouses, 328 Kenwood Hill Road (6-30-75)

Louisville, Louisville Free Public Library, Western Colored Branch, 604 South 10th Street (12-6-75)

Louisville, Louisville Water Company Pumping Station, Zorn Avenue (11-11-71)

TABLE 2.8.11-1 (Continued)

Louisville, Old Louisville Residential District, irregular pattern roughly bounded by South 7th Street on west, North-South Expressway on east, Kentucky Street on north, and Avery Street on south (2-7-75)

Louisville, Oxmoor, 7500 Shelbyville Road (7-13-76)

Louisville, Peterson-Dumesnil House, 310 South Peterson Avenue (10-31-75)

Louisville, Ridgeway, 4095 Massie Avenue (4-11-73)

Louisville, Ronald-Brennan House, 631 South 5th Street (8-11-75)

Louisville, St. James-Belgravia Historic District, bounded by Wilson Avenue on the north, South 4th Street on the east, Hill Street on the south, and South 6th Street on the west (2-5-72)

Louisville, St. Therese Roman Catholic Church, School, and Rectory, 1010 Schiller Avenue (7-28-75)

Louisville, Seelbach Hotel, 500 South 4th Street (8-12-75)

Louisville, Southern National Bank (Old Bank of Louisville), 320 West Main Street (8-12-71)

Louisville, Taylor, Zachary, House, Springfield, 5608 Apache Road (10-15-66)

Louisville, Trade Mart Building, 131 West Main Street (5-25-73)

Louisville, Union Station, 1000 West Broadway (8-11-75)

Louisville, University of Louisville Belknap Campus, 2301 South 3rd Street (6-25-76)

Louisville, University of Louisville School of Medicine, 101 West Chestnut Street (7-30-75)

Louisville, West Main Street Historic District, 600-800 blocks of West Main Street (3-22-74)

Louisville vicinity, Eight-Mile House, Shelbyville Road, North of Louisville (3-26-76)

Louisville vicinity, Locust Grove, northeast of Louisville, 561 Brankenbaker Lane (3-11-71)

Middletown, Chenoweth Fort-Springhouse, Avoca Road (7-1-75)

Middletown, Head House, Main Street (6-28-74)

TABLE 2.8.11-1 (Continued)

Meade County

Archaeological Sites

Near Indian Hill - 15 Md 10

North of Midway - 15 Md 1, 15 Md 2, 15 Md 3

North of Garrett - 15 Md 13

Intersection of SR 64 and U.S. 60 - 15 Md 12

Near Hughes Landing - 15 Md 11

North of Rodelia - 15 Md 4

West of Big Gully - 15 Md 5

South of Flipping Creek - 15 Md 6, 15 Md 7, 15 Md 8

Historic Sites

None

Oldham County

Archaeological Sites

South of Ballardsville - 15 01 200

North of Skylight - 15 01 1

Historic Sites

Crestwood vicinity, Harrods Creek Baptist Church and Rev. Kellar House, northwest of Crestwood on Old Brownsboro Road (pending)

LaGrange, Griffith, W.D., House, 206 North 4th Street (6-3-76)

Pewee Valley, The Locust, LaGrange Road off Kentucky 146 (7-30-75)

Shelby County

Archaeological Sites

Clay Village - 15 Sh 3

TABLE 2.8.11-1 (Continued)

Historic Sites

Finchville, Knight-Stout House, 1 mile north of Finchville on KY 55 (8-19-75)

Finchville, Shelby Academy (Sylvan Shades), junction of KY 148 and 55 (9-18-75)

Shelbyville, Shelbyville L&N Railroad Depot, 220 North 7th Street (6-20-75)

Shelbyville, Science Hill School, Washington Street (9-18-75)

Shelbyville vicinity, Todd, Charles and Letitia Shelby, House, 5 miles north of Shelbyville on KY 55 (6-5-75)

Simpsonville, Whitney M. Young, Jr. Birthplace, located on U.S. 60 southwest of Simpsonville (10-18-72)

Simpsonville vicinity, Old Stone Inn, located on U.S. 60 east of Simpsonville (pending)

Spencer County

Archaeological Sites

Flood Plain of Salt River - 15 Sp 200, 15 Sp 201, 15 Sp 202, 15 Sp 203, 15 Sp 204

Historic Sites

Taylorsville vicinity, Beechland (Jacob Yoker House), 2.5 miles north of Taylorsville (6-1-76)

Taylorsville vicinity, Bourne-Anderson House and Distillery Site, 0.5 miles north of Taylorsville on KY 55 (pending)

Van Buren vicinity, Love Archeological Site, west of Van Buren (pending)[c]

Trimble County

Archaeological Sites

Confluence of Kentucky River and Daugherty Creek - 15 Tm 2, 15 Tm 3

Bunker Hill - 15 Tm 5

East of Milton School - 15 Tm 1

TABLE 2.8.11-1 (Continued)

Historic Sites

Carrollton vicinity (mostly in Carroll County), Hunter's Bottom Historic District, west of Carrollton (8-11-76)

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[a] Archaeological sites are listed by federal designation, as compiled to August 9, 1976 by the Kentucky State Archaeologist (Anthropology Department, University of Kentucky). Since archaeological studies are ongoing and sites are continually being recorded, the listing in this table should not be regarded as complete or conclusive.

[b] Historic sites included in this table are those listed in the National Register of Historic Places as of February 1, 1977.

[c] Listed in the National Register of Historic Places.

2.9 OTHER PROJECTS, PROGRAMS, OR EFFORTS OF INTEREST

Just west of LaGrange in Oldham County, there is located the State Reformatory Reservation. It is bordered on the east by Dawkins Lane, on the south by Kentucky Route 146, and on the west by Kentucky Route 393. On the north, this facility extends to Cedar and Harrods Creeks.

The women's state prison is located just off Kentucky Route 362 in the extreme west of Shelby County.

Primary areas of forested lands within the Applicant's service area are in Trimble County (just outside the service area), on the extreme eastern fringes of Henry and Shelby Counties, and in eastern Spencer County, southern Bullitt County, southwestern Hardin County, and northern Meade County.

3.0 ALTERNATIVES

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3.0 ALTERNATIVES

3.1 MANAGEMENT ALTERNATIVES

3.1.1 Constraint Identification

As discussed in Section 1.0, the Louisville Gas and Electric Company forecasted peak electric demand of its customers will increase from 1,707 MW in 1976, to 2,211 MW by 1981, and to 3,543 MW by 1990. During this period, the Applicant will lose 682 MW of capacity due to retirement of its Paddy's Run Station and Units 1, 2 and 3 of its Cane Run Station and derating of its remaining existing units, all in accordance with applicable orders of the United States Environmental Protection Agency and the Louisville and Jefferson County Air Pollution Control District. Only 920 MW of new capacity is currently under construction; this new capacity will become operational in 1977 (425) and 1980 (495 MW). Even with this new capacity, the combination of growth in demand, loss of capacity due to plant retirement, and unit derating due to installation of sulfur dioxide removal systems will result in a reduction of reserve capacity to 76 MW (or less than 3 percent of peak demand) by 1984.

There are seven basic management alternatives open to the Applicant: (1) to take no steps to accommodate the new demand expected to be placed on its system (no project); (2) purchase the required additional energy from another utility; (3) uprate older units to produce the additional power; (4) reactivate retired plants to supply additional power; (5) enter into a joint project to construct a new generating plant with other utilities; (6) construct a smaller generating plant; and (7) construct the proposed plant.

3.1.2 No Project

One alternative to the construction and operation of the Applicant's proposed plant is to not provide additional generating facilities for the Applicant's service area. The inadequacy of this alternative method of responding to the future energy requirement of the Applicant's customers is clear.

As the population of the Applicant's service area continues to grow (along with the trend toward fewer individuals per household), as new industries enter the area, and as the conversion from gas to electric energy continues, the net energy demand will grow. As long as the demand grows, the Applicant, as a public utility, is obligated to supply that demand.

The consequences of the Applicant's failure to keep up with the growth in demand would be detrimental to the service area customers (industrial, commercial, and residential) and the regional economy. Reserve capacity of 20 percent or greater above the peak system demand must be maintained if reliable service is to be assured. By 1982, the Applicant would not have sufficient reserve capacity to cover a forced outage of one of its larger units, a maintenance shutdown of one of its larger units, or a combination of a series of smaller capacity losses within its system. By 1984, the Applicant would not be able to supply the full peak demand, even with all units in operation and no allowance for contingencies.

The results of an inadequate reserve would be regular brownouts and occasional or frequent blackouts, which would, at the least, irritate the residential customers, especially those in newer, all-electric homes or apartment buildings. Industrial customers, faced with the power cutbacks that such a situation would cause, could decide to cut back production, resulting in employee layoffs and reduced consumer goods, or they may decide to move from the area, thus withdrawing their financial input from the local economy. Commercial customers could reduce their operating hours, resulting in reduced income for themselves and their employees and reduced services for their customers.

The consequences of failing to meet customer demands violate the basic concept of a service organization, which is to provide the service to whomever requests and agrees to pay for it. It is, furthermore, potentially harmful to the economy of a region. In a community where: (1) the energy demands are growing; (2) the cost of energy is still within the means of the customers; and (3) the utility could provide that energy by initiating a growth project, a no-project alternative is not a viable option.

3.1.3 Purchase of Required Energy

There are two main factors militating against the purchase of required energy as an alternative means of supplying the projected increased demands on the Applicant's system: (1) lack of sufficient power available for purchase on a long-term basis, and (2) higher energy cost.

The Applicant's neighboring utilities are currently following the same kind of expansion program. This indicates that the energy demand of the region is also growing.

Electric utilities often have bilateral agreements for the exchange of power. Small amounts of power may be purchased through these agreements on a short-term basis, but the large amount of energy[1] needed by the Applicant would not be available for purchase on a long-term basis in amounts required to eliminate the construction of the Applicant's facility. Even if the energy requirement could be purchased short-term, continued purchase would require the selling utilities to construct additional generation on their systems to cover the sale.

Normally, the cost of purchased power would be higher than that which the Applicant generates itself. This is because purchase arrangements are based on the cost of producing this energy from the least efficient generating station within the seller's system. (Were the seller not providing the energy to another utility, he would not have to operate the least efficient of his stations.) For small amounts of energy, this cost is not significant and would not be felt by a purchasing utility's customers. But with the large amount of energy required by the Applicant (by 1983, more than the capacity of one of the smaller units proposed to be constructed by the Applicant), the cost would be felt by the customers. This would be an additional burden on customers who are already experiencing higher energy costs due to inflation and fuel costs. Additionally, economic results similar to those described under the no project alternative could result.

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[1] The Applicant would need to buy 40.8 MW in 1982, 276.4 MW in 1983, 448.8 MW in 1984; etc.

Furthermore, purchased power is not as reliable a source of energy to the buyer's system as that generated within a system. The amount of energy that can be received into the system from sources outside the system is limited by the capacity and reliability of the transmission system. Outages in the seller's system would be made up by reducing the amount of power being supplied to the buyer, with the potential result of brownouts or blackouts in the buyer's system.

3.1.4 Uprating of Older Plants

The Applicant has already uprated one of its older units, Cane Run #1; originally 90 MW, this unit is now 110 MW. However, there are two problems associated with uprating older facilities which limit the value of this alternative for large capacity increases.

The first problem is that existing turbines and generators can be uprated only so much; beyond a fairly small increase (compared to the required increase), new equipment would have to be installed--in essence, a new unit would have to be constructed.

However, new units cannot be constructed within the amount of space currently occupied by the older units. Not only would such units be physically larger, new units also would come under current environmental legislation which requires offstream cooling (cooling towers or lakes) and pollution control devices. Because the older units use once-through cooling, the acreage required for cooling towers or lakes was not originally provided. Further, the pollution control devices, particularly a sulfur dioxide (SO_2) scrubbing system, require additional physical space that is not available. These devices result in amounts of solid waste exceeding the capacity of the disposal acres of the original plant.

The second problem associated with uprating older facilities is that, as plants age, their equipment becomes worn and less efficient (Btu's per kW). Higher operating and maintenance costs and reduced reliability result. Thus, relying on such plants for baseload generation is not feasible (during the latter part of their operating life, older plants are used primarily for peaking and standby capacity).

The fairly small increases in power generation that can be achieved by unit upratings and insurmountable problems of inadequate site acreage at the older unit plant sites make uprating of units not a viable alternative.

3.1.5 Reactivation of Retired Plants

As an alternative, reactivation of retired plants has the same problems as uprating of older facilities, in that the retired plants would have to be retrofitted with pollution control devices, which is neither economically nor physically feasible. The capacities (even if uprated) and reliability of retired units would not be adequate to meet the projected increase in demand. Thus, new units would have to be constructed on the sites of retired plants, and this is not feasible.

3.1.6 Joint Projects

The Applicant is not a member of any utility pool and does not consider this to be a viable alternative.

Being a member of a pool or constructing a joint project does not rule out the ultimate necessity of constructing plants in the member's service area. Normally it only delays construction for a few years, or maybe not at all, depending on the growth of the peak electric demand in the pool member's service areas. When a plant is constructed, the units will be of larger capacity than the units the Applicant proposes because they are furnishing energy to more than one utility. Also, pool members have to construct an extensive transmission grid system between members to transmit the shared generation.

Historically, the Applicant's generation, fuel, and plant construction costs have been lower than those of most of its neighbors with whom it might construct a joint project. These lower costs are reflected in the Applicant's lower electric rates. Of equal importance to the Applicant and its customers is that installation of larger joint units inherently results in lower system reliability than the installation of smaller, individually owned units of equal overall capacity. Individual systems are not affected by another system's problems, as they would be under a joint arrangement.

3.1.7 Construction of a Smaller Facility

The Applicant could conceivably construct a smaller (990-MWe total) facility than that proposed and still meet its expected growth requirements through 1985. However, new capacity would be required after that time, and another plant would therefore have to be built.

There are two reasons militating against building two (or more) plants to supply the capacity represented by the proposed 2,340-MWe generating plant: (1) environmental costs, and (2) economic costs.

Because a significant amount of the land required for a power plant is for associated facilities whose size is largely independent of the generating capability of the units installed on the site, the overall land requirements for two half-size generating plants would be substantially more than that of the proposed 2,340-MWe plant. Thus, the development of two plant sites results in a marked increase in the potential effects on hydrology, water quality, aquatic and terrestrial vegetation and wildlife, land use, and aesthetics. The following is a list of plant components that would be common to both plants and of approximately the same size:

Plant Components Common to Two 990-MWe Generating Plants Occupying Approximately the Same Land Area

- Total Acreage
- Plant Service Building (offices, locker rooms, maintenance shop facilities, laboratories, warehouse, etc.)
- Screen House (for intake structure)
- Chlorine Storage
- Areas for Ash Pond, Sludge Disposal, Sediment Retention Pond, Roads, etc.
- Site Grading
- Coal Handling System
- Coal Dock Facility
- Reactant Storage
- Reactant, Oil, and Chemical Dock Facilities
- Fuel Oil Storage
- Equipment Unloading Dock Facility
- Solid Waste Treatment Facility
- Water Treatment Facility
- Waste Water Treatment Facility
- Construction Facilities

Secondly, the economies of common plant facilities would be lost by the Applicant if it constructed two plants to meet the projected increased demand that a single plant could supply. Many of the expenditures for common plant facilities in a power plant are independent of the plant capability. Thus, duplication of these facilities at a second plant would ultimately result in more expensive electricity for the customer. The cost of the facilities listed above for a 990-MWe plant on the Trimble County site with a Unit 1 in-service date of 1983 would be approximately $83,420,000. The same facilities constructed on a second site for a Unit 1 in-service date of 1987 would be approximately $122,126,000.

Besides the duplicate facilities, additional transmission lines of undetermined length would have to be constructed. The cost of these lines is estimated to be $325,000 per mile for a 1987 in-service date.

Two smaller plants would generate about 60 more jobs than a single, large plant.

In terms of the total environment, the added income from the potential additional jobs (if any) created by a two-plant alternative would not offset the greater environmental costs or the higher energy costs that would result.

3.1.8 Construction of Proposed Facility

The Applicant proposes to construct a 2,340-MWe generating plant in order to meet the growing energy demand of its service area and to replace the capacity lost through retirement of its Paddy's Run Station and Units 1, 2 and 3 of its Cane Run Station. From the standpoints of system reliability, adequate capacity, and system economics, this alternative is judged by the Applicant to be superior to all other available management alternatives.

The units of the proposed facility are scheduled to come on line one at a time. The timing of the start-up of each unit is keyed to projected demand increases that would reduce the system's reserve capacity below acceptable levels if the additional capacity represented by the new plant were not added (see Table 1.3-1). Thus, the proposed facility is designed to provide the right amount of power at the appropriate time.

3.2 POWER GENERATION ALTERNATIVES

3.2.1 Constraint Identification

There are four alternative means of generation available to the Applicant: nuclear, water, oil, and coal. Gas, because of its shortage, is not a feasible alternative. Other alternative generation means, such as solar and geothermal, have not been developed to the point where they are viable means for a system requiring large-scale, continuous generation. Pumped storage can be used only for peaking requirements. Further, in Kentucky, pumped storage is not a viable option because of the geology of the area.

3.2.2 Nuclear

The requirement for additional generation on the Applicant's system by 1983 and 1985 eliminates nuclear power from consideration for the first two units since the present estimated lead time required to license, design, and construct a nuclear unit is 8 to 10 years. Also, the economics of nuclear units indicate that the unit size should be in the 800-MWe or larger range to be comparable in operating costs to coal-fired units. At the present time, the Applicant's system does not have the reserve capacity to support an 800-MWe or larger unit (i.e., the system could not support the outage of a unit of this size).

Therefore, a nuclear facility is not a feasible alternative at this time.

3.2.3 Water

The large-scale use of hydroelectric energy in the Ohio Valley region is not feasible because of the lack of suitable hydroelectric sites.

3.2.4 Oil

As fuel for the generation of electricity, oil at present in Kentucky is not a viable alternative. The use of oil as a fuel for electric generation is presently being curtailed by government regulation. Furthermore, in a state with the large coal reserves that Kentucky has, it does not make much sense to substitute a fuel which is more costly, less abundant, and, because most of it would be imported from a foreign source, less reliable than coal.

3.2.5 Coal

Coal to supply the Applicant's electric generation needs is available in abundance in Kentucky in varying sulfur contents. The Applicant has proposed to use western Kentucky coal with its higher sulfur content because this coal is reasonably certain to be available in a sufficient quantity for the life of the plant. Also, western Kentucky coal is presently the best economic choice, even though the sulfur emissions have to be controlled with scrubber systems.

Low sulfur coals from the western states have been ruled out as an alternative because Kentucky coal is a cheaper and more reliable source of fuel.

Washing western Kentucky coal improves its Btu output and lowers the amount of sulfur and other impurities. Washed coal may be feasible when it becomes more plentiful, provided costs are not excessive.

3.3 SITE ALTERNATIVES

3.3.1 Introduction

The following is a discussion of alternative sites considered for the 2,340-MWe fossil-fueled generating plant proposed to be constructed by the Applicant. The area of interest for identification of alternative sites was a region encompassing the Applicant's service area and peripheral areas. This region is described in Section 2.0. The present discussion provides a summary of the criteria used in the site selection process and a description of seven candidate alternative sites. Technical Appendix I contains a description of 10 additional sites originally selected for analysis but eliminated almost immediately from further consideration. Section 3.3.4 compares the various candidate sites and identifies the Trimble County site as the preferred alternative.

3.3.2 Siting Criteria and Constraints

Introduction

Despite the large area of north-central Kentucky investigated (approximately 1,700 square miles), only a limited number of candidate power plant sites could be identified because of several major constraints. These are rough topography; preemption of large land areas by other intensive land uses; and remoteness (and, therefore, excessive economic and environmental costs) from cooling water source, fuel transportation access, transmission grid, and load center. Jefferson County, in which the city of Louisville is situated, was eliminated as a candidate siting area because of extensive urbanization and restrictive air quality classification. Potential degradation of air quality is also a serious concern in other portions of the candidate siting area. The following paragraphs describe the procedures and criteria used in the identification of alternative sites.

Site Selection Procedures

The factors considered in the site selection process were land use, cultural and recreational features, ecology, aesthetics, water supply, water quality, geology, natural and man-related hazards, meteorology, and air quality. Certain major cost-related factors associated with site development and plant operation were also considered on an order-of-scale basis in order to provide a means of economic comparison of selected candidate sites. These include cost of transportation of coal and other materials, cost of transmission, cost of developing a cooling water supply, and cost of site preparation.

The methods used in the siting study consisted of: (1) collection and evaluation of pertinent published and unpublished data on natural resources and land uses; (2) identification and definition of all operational and environmental siting criteria; (3) evaluation of the basic environmental and physical factors on a regional basis; (4) definition of the general candidate siting region; (5) selection of candidate siting areas and specific candidate sites within the general region by means of map study; and (6) evaluation of the candidate sites by field inspection and by application of the siting criteria.

The initial evaluation of the study region, in view of the type and size of the desired new generating facility, indicated that the most limiting siting factors were: (1) meeting applicable air quality standards; (2) obtaining adequate cooling water supply; (3) obtaining a sufficiently large tract of land having favorable topography; and (4) obtaining a site close enough to the Applicant's existing transmission grid and load centers, to coal transportation facilities, and to cooling water supply without incurring excessive economic costs.

Boundary of Candidate Siting Region

General Region

The general region considered in the search for potential fossil-fueled power plant sites contained those counties in north-central Kentucky within the Applicant's service area, counties served in part by the Applicant, and nearby counties within roughly 50 miles of Louisville. Therefore, the general siting region included Bullitt, Carroll, Hardin, Henry, Jefferson, Meade, Oldham, Shelby, Spencer, and Trimble Counties. An additional area considered initially was the Western Coal Field area/Green River basin in Muhlenberg County because this area would provide a nearby source of coal and an adequate supply of cooling water. However, its considerable distance from the Applicant's load center and the extremely high costs of constructing the large capacity transmission lines that would be required eliminated this area from further investigation.

The importance of sites being near an adequate water supply and fuel transportation routes caused special attention to be given to areas adjacent to major rivers and within reasonable distances of the Applicant's load center and transmission system. It was determined early in the siting process that much of the inland area of the counties investigated offers few favorable locations for the proposed facility. This is due to such factors as lack of potential water supply, excessive distance to rail lines for fuel transportation, excessive transmission distances, and large areas of land within military reservations or other intensive or dedicated land uses. Potential sites located in Indiana were not considered because of the difficulties in licensing an out-of-state utility.

Specific Region

Following a general review of land and water resources data and a review of data developed by the Applicant and its design engineering consultants, it was concluded that apparent gross economic disadvantages and failure to meet vital operational requirements (water supply and fuel transport) eliminated much of the general region from further detailed study. The specific candidate siting region was therefore defined as an approximately 10-mile-wide belt along the Kentucky side of the Ohio River. This belt begins near Madison, Indiana and extends downstream to a point near the boundary between Meade and Breckinridge Counties (across the Ohio River from the Indiana community of Derby). The 10-mile width was assumed to be the maximum distance inland from the Ohio River over which water could feasibly be conveyed.

Jefferson County, in which the city of Louisville is situated, was entirely eliminated in the search for specific candidate sites because the county is: (1) nearly completely urbanized; and (2) has been designated an Air Quality Maintenance Area for particulates and sulfur dioxide (SO_2) emissions (Federal Register, Vol. 40, No. 175, Sept. 9, 1975). This means that the air resources of Jefferson County cannot support any additional major new sources of air pollutants.

While the identification of candidate sites was confined to locations within the specific region, the potential environmental effects associated with power plant development were generally considered to extend out from the site for approximately 25 miles.

Siting Criteria

Site Development Criteria

The following factors or site qualities pertain to plant operational requirements and were used as an aid in determining the technical and economic feasibility of the candidate sites.

Size and Type of Power Generating Station. Selection of candidate sites is dependent on the generating capacity of the proposed plant. Because of the economies of scale and anticipated future power needs, the Applicant desires to construct on one site a four-unit facility with a total capacity of 2,340 MWe. In this site selection study, the specific candidate siting region has therefore been screened for only those sites capable of supporting a generating facility of approximately 2,400 MWe.

Engineering Criteria for a 2,340-MWe Facility. The following are the preliminary design criteria for the facility proposed by the Applicant.

Unit	Capacity	Operational Date
1	495 MWe net	June 1983
2	495 MWe net	June 1985
3	675 MWe net	June 1987
4	675 MWe net	June 1989

1. Units and unit sizes - two 495-MWe (net); two 675-MWe (net)
2. Unit life - 30 years
3. Capacity factor - first 20 years: 60 percent annual average; last 10 years: 25 percent annual average
4. Net unit heat rate - 9,800 Btu per kW
5. Unit firing - Alston #1 raw coal (4.29 percent sulfur content)
6. Cooling system - closed loop, utilizing natural draft cooling towers: one for Units 1 and 2; one for Units 3 and 4

7. Scrubber system - wet type, utilizing limestone ($CaCO_3$)

8. Solid waste disposal volume generated over the life of the plant - 60,000 acre-feet

9. Coal consumption rate - 26,300 short tons per day (maximum)

10. Coal storage requirements - 1,565,000 short tons (maximum)

11. Limestone consumption rate - 5,500 short tons per day (maximum)

12. Limestone storage requirements - 271,000 short tons (maximum)

13. Fuel oil consumption rate - 50,000 gallons per week (maximum)

14. Liquid chemicals consumption rate - 56,000 gallons per week

15. Maximum water intake - 69,000 gpm

16. Maximum water consumption - 50,000 gpm

17. Maximum water discharge - 40,900 gpm

Water Supply. The water supply required for plant cooling should be at the site or in the near vicinity. If water is pumped to the site, it is desirable to keep the pumping head to a minimum. A source of potable water should also be near the site.

In determining the adequacy of surface water supplies, the following guiding criteria were applied:

1. Ten percent of the 7-day low flow rate (10-year recurrence interval) was defined as the allowable water withdrawal rate

2. If 10 percent of the 7-day, 10-year low flow was inadequate for cooling, a less rigorous criterion, allowing the withdrawal of water flow in excess of the lowest mean flow for 30 consecutive days of a 10-year recurrence, was applied. Generally, this means that the excess flow will be withdrawn from a retention pool and stored in an off-channel reservoir

3. The quality of cooling water should not require pretreatment. Intake and blowdown discharge structures should be far enough apart to prevent thermal interaction

Method of Waste Heat Dissipation. Natural draft cooling towers were the only method considered in evaluating the ability of sites to provide waste heat dissipation, as these are preferred by the Applicant. Blowdown water was required to meet the thermal water quality standards established for the receiving streams (see following "Water Quality" discussion).

Land Acquisition. Precise criteria are difficult to specify, but, generally, areas with the following characteristics were preferred: (1) the smallest number of individually owned parcels; (2) the lowest land values; and (3) a configuration of individual parcels with site boundaries that encompass the least number of parcels.

Topography. The terrain should be relatively level in plant construction areas to minimize costs of site grading. Near the site, however, the terrain should have a natural relief capable of being used for solid waste storage--for example, a natural ravine having a storage capacity of 60,000 acre-feet.

The elevation of the site should be above flood levels (maximum flood with existing controls) on adjacent streams; or, in the absence of controls, the site should be high enough to minimize costs of constructing flood protection dikes for the maximum flood of record.

The elevation of the site with respect to surrounding terrain should be such that cooling towers and stacks can be feasibly constructed and will function in the desired manner (see following "Air Quality" discussion).

Topography of the site vicinity should be amenable to construction of transmission lines, highway and rail access (as necessary), and water intake and discharge lines. Pumping costs are highly dependent on elevation differences between the site and water source and the length of pipeline required.

Geologic Conditions. To support the power plant structures, site soils must have a minimum bearing capacity of 6,000 psf, or soils should be suitable to support friction or bearing piles of 50-ton minimum capacity.

The site must not be in close proximity to active earthquake faults.

Within the site boundaries or in the close vicinity, impervious soils should be available for use as linings under coal storage piles and ash storage ponds.

Rock conditions should allow the development of coal and solid waste storage sites that will not endanger the quality of ground and surface water resources or the safety of people and property down-slope from the waste storage sites. Additionally, if water reservoirs are to be constructed, rock conditions must be such that seepage losses are not excessive, and the abutments of dams are secure against failure.

Transmission Development. The site should be located in close proximity to the transmission grid where the power will be consumed. Two 250-foot-wide right-of-way corridors from the site must be available to accommodate transmission line systems.

Transportation Access. The site should be accessible by highway for construction and operating personnel and it should be located a reasonable distance from Louisville, Kentucky, in order to limit travel cost for construction crafts. It must be accessible by rail or barge to bring in power plant equipment construction materials and consumables for plant operation.

Environmental Criteria. These are factors pertaining to the environmental compatibility and acceptability of construction and operation of a 2,400-MWe facility (for example, public health considerations, land use compatibility, impact upon cultural and natural resources, and ecological effects).

1. Air Quality - A major consideration in siting a fossil-fueled power plant is whether the emissions will exceed ambient air quality standards. This is determined by adding estimated plant emissions to the existing ambient baseline concentration values for the significant air pollutants (as defined by federal and state agencies). Controlling criteria were the standards for SO_2 and particulates emissions. These are summarized in the following table (see Section 5.1.2 for explanation of the various standards).

Ambient Air Quality Standards

Primary Standards: SO_2 - 80 $\mu g/m^3$ (annual average)
Particulates - 75 $\mu g/m^3$ (annual average)

Secondary Standards: SO_2 - 60 $\mu g/m^3$ (annual average)
Particulates - 60 $\mu g/m^3$ (annual average)

The Louisville and North Central Kentucky Air Quality Control Regions (AQCR) are the control agencies for the siting region. The Louisville AQCR classification is Priority I (see Section 5.1.2) for both particulates and SO_2; the North Central AQCR is classified Priority II for particulates and Priority III for SO_2. The various class standards are defined as follows:

Priority Class Standards

	Particulates (Annual Arithmetic Mean)	SO_2 (Annual Arithmetic Mean)
Priority I	>95 $\mu g/m^3$	>0.04 ppm
Priority II	60-90 $\mu g/m^3$	0.02-0.04 ppm
Priority III	<60 $\mu g/m^3$	<0.02 ppm

As previously noted, Jefferson County (within the Louisville AQCR) has been designated an Air Quality Maintenance Area (Federal Register, Vol. 40, No. 175, Sept. 9, 1975), and, thus, the county is eliminated from the candidate siting region. The North Central AQCR will accommodate new sources and therefore was included in the candidate siting region.

In determining whether an area is suitable for a power plant site, attention must also be given to whether or not the plant will exceed the "significant deterioration increment" of the region (see Section 5.1.2).

Meteorologic and terrain conditions were considered in evaluating candidate sites from an air quality standpoint. Level terrain and good ventilation result in lower economic costs in the development and operation of plant systems, better dispersion of air emissions, and less impact from fogging and icing induced by cooling tower operation.

The potential effects on agriculture, native vegetation, and air, highway, and river traffic of SO_2 emissions, cooling tower fogging, acid mist due to interaction of stack plumes and cooling tower plumes, and salt drift were generally considered in site evaluation

2. Water Quality - Stream water quality standards promulgated by applicable regulatory agencies must be met. Siting considerations relative to these regulations include design and location of water intake and discharge structures, quantity of water consumptively used, anticipated quality of discharged water, effects of runoff from materials storage and solid waste disposal areas, and disturbance of natural drainage watercourses by construction.

   Water quality criteria of main concern for discharges from steam electric generating stations involve dissolved solids and temperature standards

3. Aquatic Ecology - Unique fishery locations or migration patterns were considered in siting. The ecology of fish populations would be impaired by significantly reducing existing low-water flows or altering the temperature regime, particularly by abrupt changes of short duration. Alteration of fish habitat conditions by construction of dams and reservoirs or other structures was also considered. In some instances, reservoirs may be operated to augment low flows downstream to the benefit of fish habitat conditions

4. Terrestrial Ecology - Site development must avoid or cause only minimal disturbance to unique terrestrial habitats or endangered species. Designated scientific areas, state parks, and other public lands set aside for the preservation of native vegetation and wildlife were excluded from the candidate siting region

5. Population - For fossil-fueled plants, no specific criteria have been established for human population density and residential distribution around the site; however, the site selection process favored areas of low population density

6. Land Use

   a. Restricted Areas - Areas that were not considered as candidate siting areas included local, state, and national parks, wilderness and recreation areas, historical and archaeological sites, wildlife refuges and management areas, critical or unique wildlife habitat, and wild or scenic rivers

   b. Sensitive Areas - Sensitive areas are those not likely to be compatible with construction and operation of a nearby power plant. These areas include state and national forests, public hunting grounds, military reservations, other public lands not included under (a) above, marshes, shoreline zones, prime agricultural land, land zoned for nonindustrial uses, areas near airports and along low-level air routes (the site must not be in an air traffic flight path; this would prevent construction of stacks in excess of 600 feet in height), and land areas that may be candidates for future recognition as scenic or recreation areas

   c. Other Areas - Most favorable siting opportunities are found on marginal farmland, low quality woodland, and other land of nonintensive use. Planning reports developed by regional and state agencies were reviewed to determine the overall compatibility of a power plant with land use plans and goals of the siting areas

7. Public Safety Considerations - Health hazards are taken into account by air and water quality regulations. Considerations of public safety, as well as the safety of the planned facilities, dictate that the site not be located in close proximity to a source of hazard--for example, arsenals, chemical factories, tank farms, gas fields, areas of mineral withdrawal, earthslides, or tornado "alleys"

8. Socioeconomics - The potential effects of site development were evaluated for such items as population characteristics (including distribution and growth trends), labor force location, regional economic development, and land use patterns

9. **Aesthetics** - Precise criteria for evaluating impacts on the aesthetic qualities of an area are difficult to define. Designated scenic areas were not considered for sites. The impact of potential transmission routes from the plant site on aesthetic qualities was considered in site evaluation

3.3.3 Candidate Sites Description

Brandenburg Site

Location

This site (Figure 3.3.3-1) is located on the Ohio River flood plain (River Mile 644.5). It is in Meade County, Kentucky and is bounded on the west by the city of Brandenburg, Kentucky and on the east by the Olin Corporation plant at Doe Run (Quadrangle - Mauckport, Ind.-Ky., USGS 7.5 minute series).

Size, Topography, and Geology

Approximately 700 to 800 acres of nearly level land is available. Along the southest side, Flippins Run forms a valley that is incised into the flood plain parallel to the base of the bluff. Nearly half of the site has an elevation of 450 feet or more; the normal pool elevation of the Ohio River at this point is 383 feet. The adjacent bluffs range from 500 to 620 feet in height. In places, springs emanate near the base of the bluff and flow into Flippins Run. The flood plain consists of unconsolidated alluvial sediments which are probably adequate for power plant foundations.

Site Development

Barge docking facilities on the Ohio River at the site would allow transportation of construction materials, plant components, coal fuel, and other materials used in plant operation. A Louisville and Nashville rail line near the east end of the site provides a potential alternate means of transporting materials to the site. The site could be reached by highway via extensions from State Highway 933 or by improvements to the "Ohio River Trail" road, which runs from Brandenburg along the southern edge of the site.

The Applicant presently has a 69-kV service line into the Olin plant at Doe Run; however, it is unlikely that this corridor would be used in transmitting power from the Brandenburg site. The nearest point on the existing 345-kV grid is approximately 13 miles away near Mill Creek; a direct routing would cross the Ohio River and go through Indiana. An alternate or possible route for a second line (needed for system reliability) would be to the existing 154-kV line corridor from Cloverport, approximately 11 miles from the site.

Water for cooling would be obtained from the Ohio River adjacent to the site. Intake and discharge structure locations may be affected by similar facilities now being used by the Olin plant.

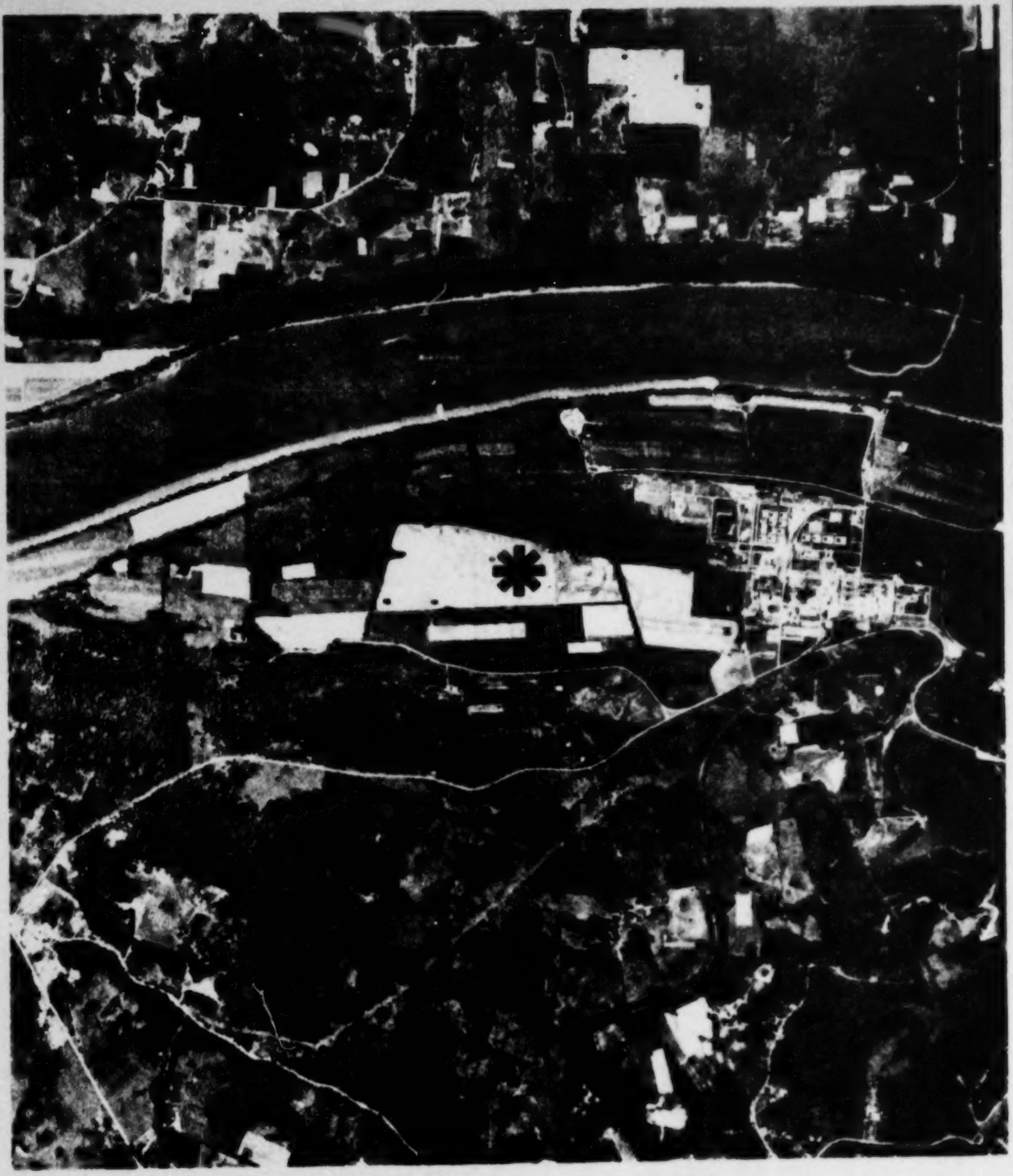
Opportunities for a solid waste storage area with a capacity of 60,000 acre-feet are poor on the site. Possibly some storage could be obtained in depressions in the undeveloped area south of the site.

Air Quality Conditions and Effects

With bluffs rising roughly 200 feet on either side of the Ohio River near the site, there is a potential for aerodynamic plume downwash and the necessity for a tall stack to carry effluents well out of the valley. The site is located near the Olin Corporation's Doe Run plant, which in 1973 emitted nearly 4,000 tons of SO_2. However, data are insufficient to evaluate ambient air quality at the site vicinity. Across the river in Harrison County, Indiana, there are no major sources of pollutants, with the exception of stone quarries. The Applicant's Mill Creek plant and the Kentucky Solite Corporation plant, both located approximately 15 miles to the east, are other nearby sources. These emitted a total of approximately 46,000 tons of SO_2 in 1973. Winds from the southwest through west sectors, which occur 19 percent of the time annually, would carry plant effluent into the Jefferson County area, where SO_2 concentrations are already in excess of the primary ambient air quality standard. This is considered to be a major disadvantage of the site. Because the site is in the valley, there is a potential for cooling tower-induced fogging and icing on highways and structures, particularly on bluffs adjacent to the site. However, much of the bluff area north and south of the site is uninhabited; thus, these effects should not be a serious problem when the wind is westerly or southerly. Easterly winds could cause cooling tower and stack drift to affect Brandenburg.

Land Use - Ecology and Effects

Except for a few small sheds and barns, the major portion of the site is free of buildings. Two residences occur along the road on the south side of the site. A small park and a sewage disposal facility are located at the west end. At the east end, there is a large industrial facility (Olin's Doe Run plant), with tank fields, rail spurs, and rail yard. A short distance to the southeast is the Doe Run recreational area containing a reservoir, beach and marina, and new residential/estate-type developments. The bulk of the site area consists of farmland. Wooded areas occur along Flippins Run, the bluff on the south side of the site, and in a drainageway in the west central part of the site. No important terrestrial or aquatic habitats are likely to be present in the area affected directly by site development; however, the bluff area along Flippins Run may harbor endangered plant species. The area would derive economic benefits from a generating plant, but there may be public opposition on the basis of impaired air quality.



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TRIMBLE COUNTY GENERATING PLANT

BRANDENBURG SITE

FIGURE 3.3.3-1

Chief Advantages and Disadvantages

The chief advantages are access to adequate cooling water and Ohio River barge transportation, and proximity to the Louisville load center. Access to a rail line and good site drainage and elevation are additional advantages. The chief disadvantages are possible adverse effects on air quality in the vicinity and probable public opposition on this basis. Also, the difficulty of developing an adequate solid waste disposal area on the site is an important disadvantage. The site is somewhat limiting in size for a four-unit, 2,400-MWe generating facility.

Garrett Site

Location

This upland site (Figure 3.3.3-2) is located in Meade County, Kentucky east of Garrett and north of U.S. Highway 60 (Quadrangle - Rock Haven, Ky.-Ind., USGS 7.5 minute series).

Size, Topography, and Geology

About 800 or 900 acres of rolling land east of Garrett and Kentucky 448 and north of U.S. 60 could be developed for a power plant. Elevations in this area generally range from 720 to 760 feet, though Miles Hill, on the north part of the site, rises to an elevation of 830 feet. Miles Hill and other knobs in the area are erosional remnants. The eastern part of the site is dotted by sinkhole depressions. The site area is underlain by Mississippian limestones that are affected strongly by solution weathering. This weathering could result in problems with foundation support, integrity of water reservoirs, and possible ground water contamination from coal pile and solid waste storage areas.

Site Development

This site is nearly 5 miles from the Ohio River; hence, transport of coal and other materials to the site would necessarily be by rail. A spur line would have to be constructed either for 5 miles from the Louisville and Nashville Railroad or for a distance of 8 miles from the Illinois Central Railroad. In addition, cooling water would have to be conveyed to the site from the Ohio River for a distance of approximately 5 miles, requiring a pumping head in excess of 350 feet. A water storage reservoir would need to be constructed on the site. Natural depressions on the site could be used for a reservoir, but the chance of excessive leakage is great due to karstic development in this region. The karstic terrain also is problematical for obtaining sound foundations, and rolling topography would require extensive site grading. Site development costs are, therefore, apt to be very high. This site typifies the problems associated with development of upland sites in much of the Applicant's service area and vicinity.

Transmission lines from this locale would have to be constructed for a distance of approximately 16 miles to the nearest point on the existing 345-kV line.

Air Quality Conditions and Effects

Located out of the river valley and at a relatively high elevation, this site has diffusion characteristics that would possibly make stack heights in excess of 700 feet unnecessary. Major sources of SO_2 within approximately 25 miles of the site and the 1973 emission rates of these are: the Applicant's Mill Creek plant (42,220 tons per year) in Jefferson County, Kentucky Solite Corporation (3,406 tons per year) in Bullitt County, and the Olin Corporation (3,984 tons per year) in Meade County. Because of the site elevation, cooling tower-induced fogging and icing on nearby roads and structures would present no problem.

Land Use - Ecology and Effects

The interior portion of the site is sparsely populated, with most residential development along the major highways. The land is used for low intensity agriculture; some row crops are grown but, for the most part, the land is used for pasture or is idle oldfield. Scattered woodlots occur throughout the area. Pipelines are located in the vicinity though none cross the site. A substation is located near Garrett and a transmission line crosses the site (these are not the Applicant's facilities). Development of a site in this area would have little adverse effect on terrestrial ecology other than disturbance of scattered woodland habitat supporting small mammals and birds.

Chief Advantages and Disadvantages

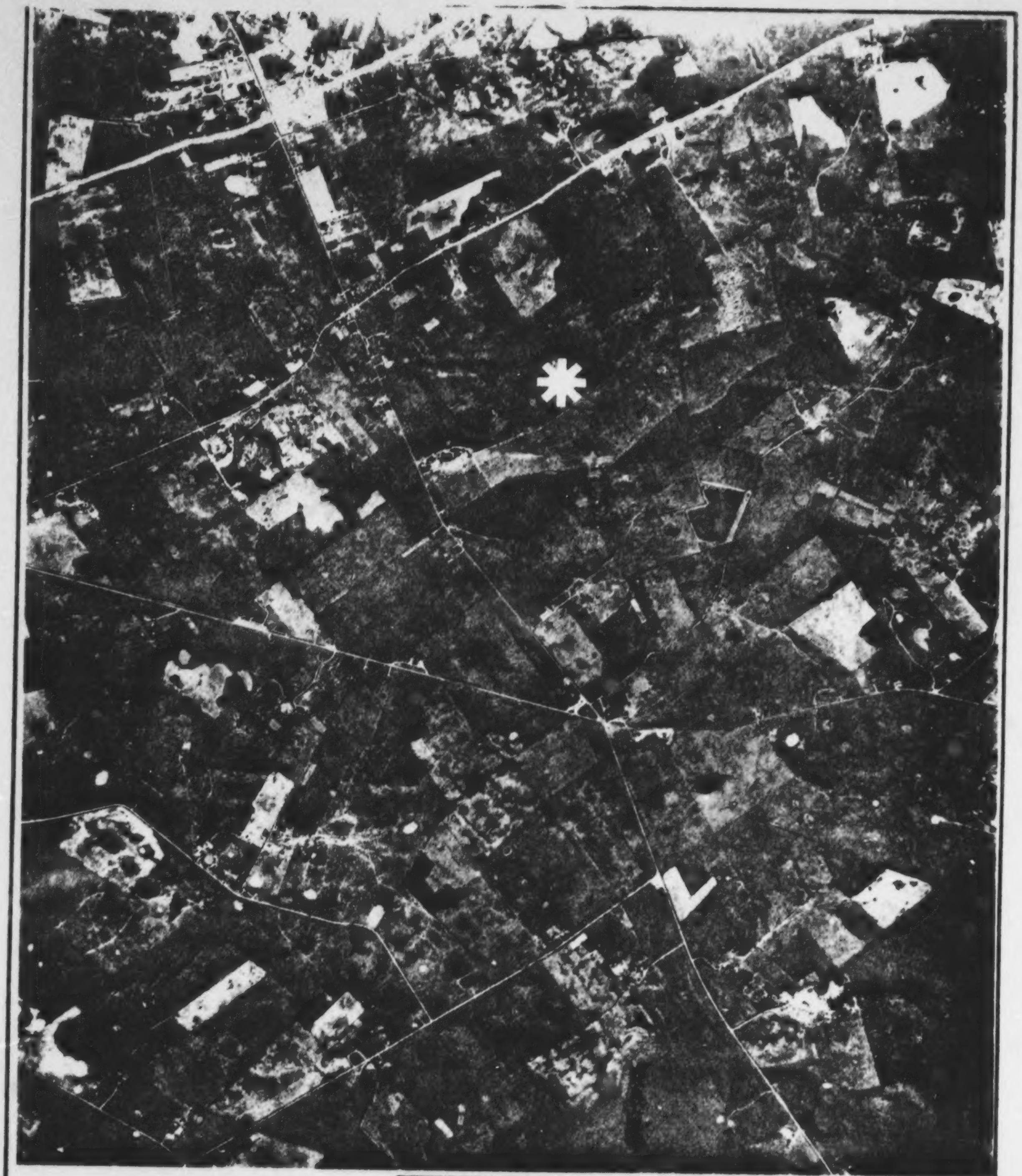
The chief advantage of this site is the favorable ventilation of its upland location, which makes it possible to have shorter stacks and to escape the air quality problems associated with a deep valley location.

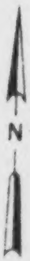
There are many serious problems, however, in constructing on an upland site in karst terrain. In fact, site development may not be technically feasible because of the poor foundation conditions. At best, high costs would be incurred in correcting such conditions and in protecting the ground water resource of the area and developing rail access and a water supply to this site.

Hampton Creek Site

Location

This site (Figure 3.3.3-3) is on a high terrace of the Ohio River (River Mile 555) 4 miles east of Madison, Indiana. It is located in Carroll County, Kentucky between the Carroll-Trimble County line and Hampton Creek. It is outside the Applicant's service area but is less than 50 miles from the center of Louisville, Kentucky (Quadrangle - Madison East, Ky.-Ind., USGS 7.5 minute series).





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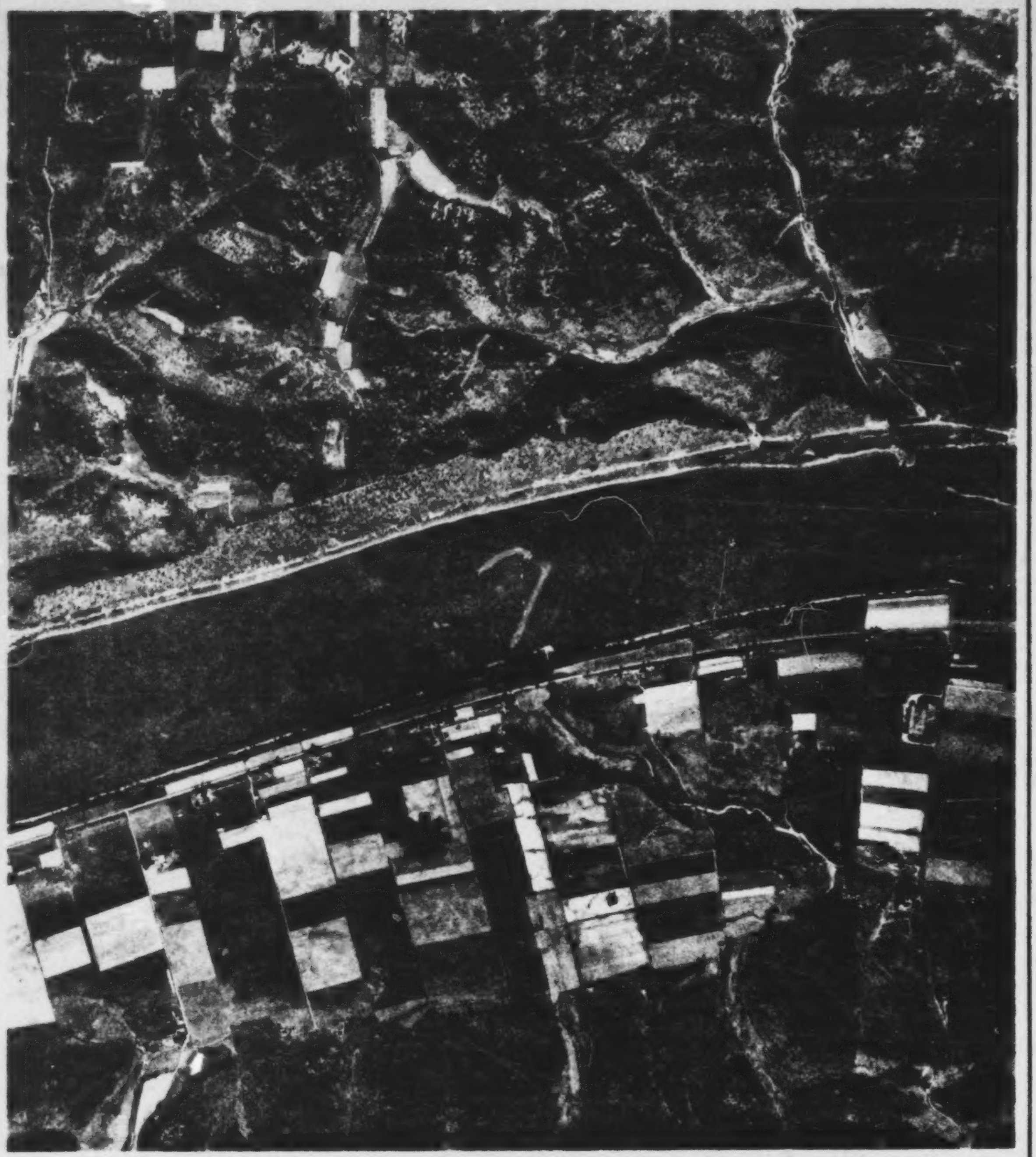
TRIMBLE COUNTY GENERATING PLANT

GARRETT SITE

FIGURE 3.3.3-2



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TRIMBLE COUNTY GENERATING PLANT

HAMPTON CREEK SITE

FIGURE 3.3.3-3

Size, Topography, and Geology

Between 1,000 and 1,200 acres of nearly level or gently sloping land comprise this location. The site is primarily a high river terrace with elevations ranging from 480 to 500 feet. The normal pool elevation of the Ohio River at this point is 420 feet. The site has excellent drainage and would be free from flooding hazards. Good foundation conditions (probably alluvial sands and gravels in this area) exist for plant structures.

Site Development

Because of the highly favorable terrain and soil conditions of this site, development costs would be comparatively low. Barge docking facilities and water intake and discharge structures could be readily developed in the Ohio River adjacent to the site. Coal would have to be conveyed over or under Kentucky 36, a locally heavily travelled highway that would provide easy access to the site. Transmission lines would have to be constructed for a distance of approximately 6 miles to tie into the Applicant's 345-kV line running south from the Clifty Creek plant.

Air Quality Conditions and Effects

The Hampton Creek site is located in an area of the Ohio River Valley that has bluffs of 400 to 450 feet on either side of the river. The bluff heights would necessitate very tall stacks to overcome aerodynamic plume downwash and plume trapping within the valley. In this area, ambient air quality is good, with pollutant concentrations generally below the secondary ambient air quality standards. The only major sources of pollutants within 25 miles of the site are the Clifty Creek Power Plant near Madison, Indiana and the Kentucky Utilities Power Plant near Ghent, Kentucky. In 1973, the Clifty Creek Power Plant emitted approximately 47,700 tons of SO_2, while SO_2 emissions from the Kentucky Utilities Power Plant were approximately 48,700 tons for the year. Since prevailing winds carry plant emissions to the north and northeast, interaction with plumes from either of these plants would be negligible. However, winds from the east or west would cause ground-level concentrations of pollutants from these sources, as well as from a potential new plant, to be additive.

Kentucky Route 36 and Indiana Route 56, both of which parallel the river, might be subject to fog induced by cooling towers, although a greater fogging potential exists on bluffs adjacent to the site.

Land Use - Ecology and Effects

Site development would preclude the present agricultural use of the land. This area is fully cleared, with woodlands restricted to the steep slopes of the adjacent river bluffs. There would be few impacts of importance on the area wildlife because essentially no natural habitat would be destroyed. The majority of people in the site vicinity live in houses located along Kentucky 36. While the site perhaps could be developed without requiring relocation of these residences, the effects of plant operation on the people and their environment might dissuade them from remaining in the immediate plant site area. Because Kentucky 36 is heavily used, it could not be disrupted by site development nor can it be relocated to any advantage. A sand and gravel operation east of the site would not be adversely affected by site development.

Chief Advantages and Disadvantages

Direct access to the Ohio River for a source of cooling water and barge transportation of coal and other materials; the good drainage, foundation conditions, level topography, and size of site; and proximity to the Applicant's 345-kV transmission grid are all important advantages of this site.

Disadvantages are the additive effects of air emissions from a new plant at this site to the emissions from the power plants at Clifty Creek and Ghent. The impact on residences along Kentucky 36, on the agricultural use of good quality cropland, and the effect on the aesthetics of an area heavily travelled and densely populated are other disadvantages.

The American Electric Power Company has an interest in a tract of land near this site; however, it is not known whether the boundaries overlap or coincide with those of the Hampton Creek site as described herein. One major plant in this immediate vicinity would probably preempt the siting of a second fossil-fueled plant because of air quality restrictions. There is currently a great deal of public opposition to new power plants anywhere in this section of the Ohio River Valley.

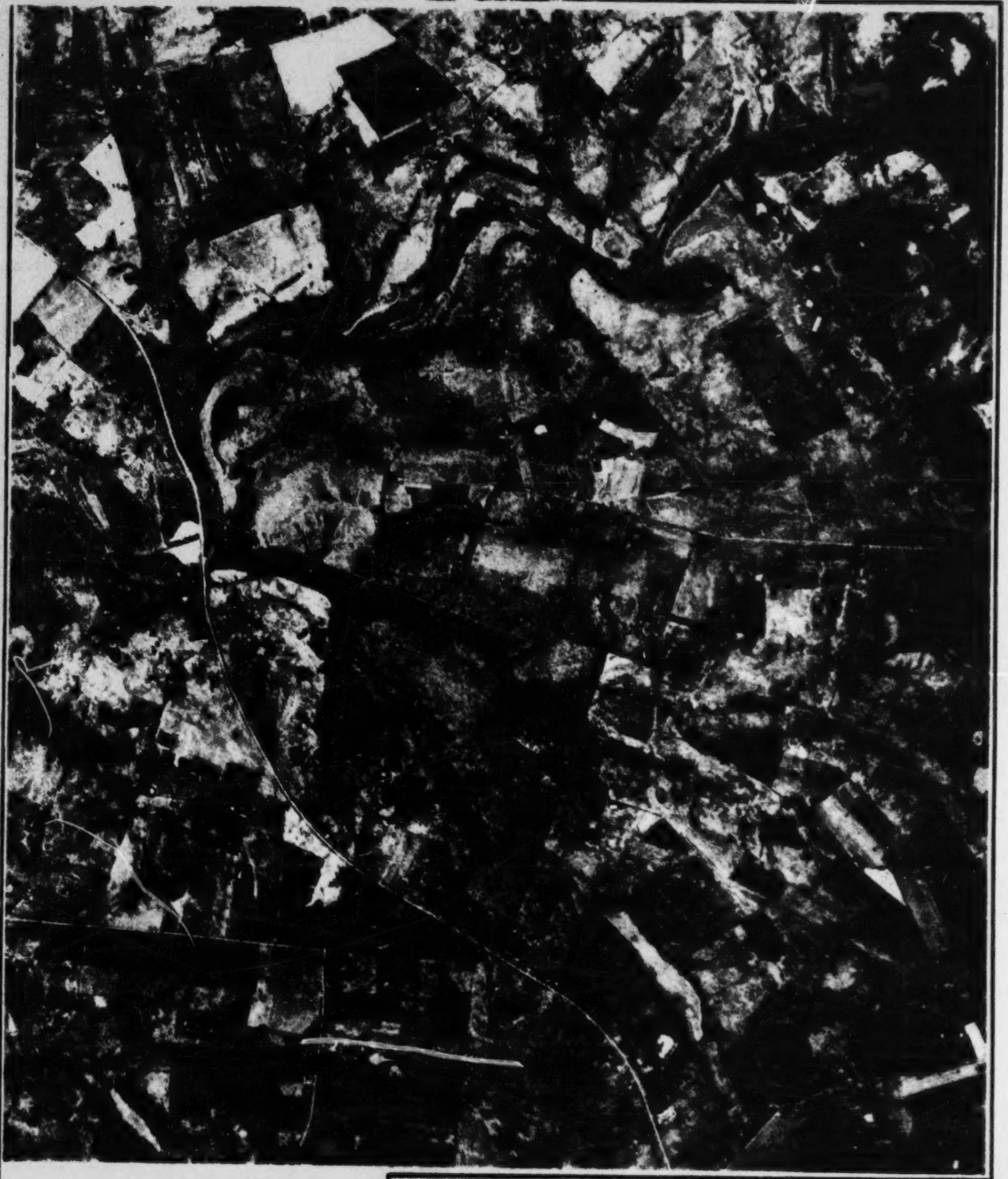
LaGrange Site

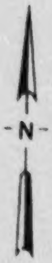
Location

This upland site (Figure 3.3.3-4) is located west of LaGrange, Kentucky, east of U.S. 42, near Harrods Creek, and approximately 4 miles inland from the Ohio River. It is in Oldham County, Kentucky and within the Applicant's service area (Quadrangle - LaGrange, Ky.-Ind., USGS 7.5 minute series).

Size, Topography, and Geology

The site consists of gently rolling ridge tops lying between Harrods Creek and North Fork and Cedar Creeks. Six hundred or more acres could be used in site development; however, the gentle topography is limited to about 300 acres in a strip along Backbone Road. On either side, there are steep slopes caused by stream erosion. Elevations at the site generally range from less than 650 feet to over 820 feet. Normal pool elevation of the Ohio River nearest the site is 419 feet. The site is probably underlain by Silurian limestone, perhaps with Ordovician sedimentary rocks occurring at the higher elevations. While karstic topography does not appear highly developed in this area, solution weathering phenomena may occur in the site area and influence foundation conditions and reservoir construction.





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TRIMBLE COUNTY GENERATING PLANT

LAGRANGE SITE

FIGURE 3.3.3-4

Site Development

Owing to the rough topography, and possible extensive solution-channeling of underlying rocks, site preparation would probably be quite costly. This would be especially true if large-scale grouting would be required for foundations and for the dam for the emergency water reservoir. Sealing the reservoir and the ash storage pond against leakage might also require special measures.

A spur track would have to be constructed from the Louisville and Nashville Railroad line near Buckner, Kentucky, a distance of 5 miles over rough terrain. The site is less than 2 miles from the Applicant's 345-kV line, which passes in a north-south direction east of the site.

Air Quality Conditions and Effects

Because this is a high upland location, site diffusion characteristics are such that stack heights in excess of 700 feet may not be necessary.

The nearest major source of SO_2 is the Clifty Creek Power Plant in Madison, Indiana, 20 miles to the north. Total 1973 SO_2 emissions from this facility were approximately 47,700 tons. Sulfur dioxide emissions from Oldham County and all neighboring counties except Jefferson, to the southwest, totalled less than 900 tons in 1973. Air quality in the vicinity of the site is good, with pollutant concentrations generally below the secondary standards. Predominant south through west winds in the region would often carry effluent away from the Louisville and Jefferson County areas.

Because of the site's elevation, cooling tower-induced fogging and icing on nearby roads and structures should present no problem.

Land Use - Ecology and Effects

The entire site area is in agricultural and woodland uses on the steep slopes of ravines leading from the site to nearby creeks. There are two orchards on the eastern end of the site. At least five residences would be affected by site development, and wildlife habitat in the ravines and creek bottoms would also be adversely affected; however, it is unlikely that any unique habitats exist since most areas have already been disrupted by cultivation and grazing. Siltation and runoff from the site could adversely affect Harrods Creek unless protective measures were employed.

Chief Advantages and Disadvantages

The chief advantage of this site is the favorable ventilation due to the upland location, a factor that allows for reduced stack construction costs and air quality problems. Also, proximity to the 345-kV transmission line is advantageous.

Disadvantages are the high costs of site preparation and development of water supply and coal transportation facilities. Besides high initial capital costs, there would be high annual costs associated with pumping water over a substantial height and distance. Protection of ground water resources may be difficult in an area where solution channeling of bedrock may be extensive.

Trimble County Site

Location

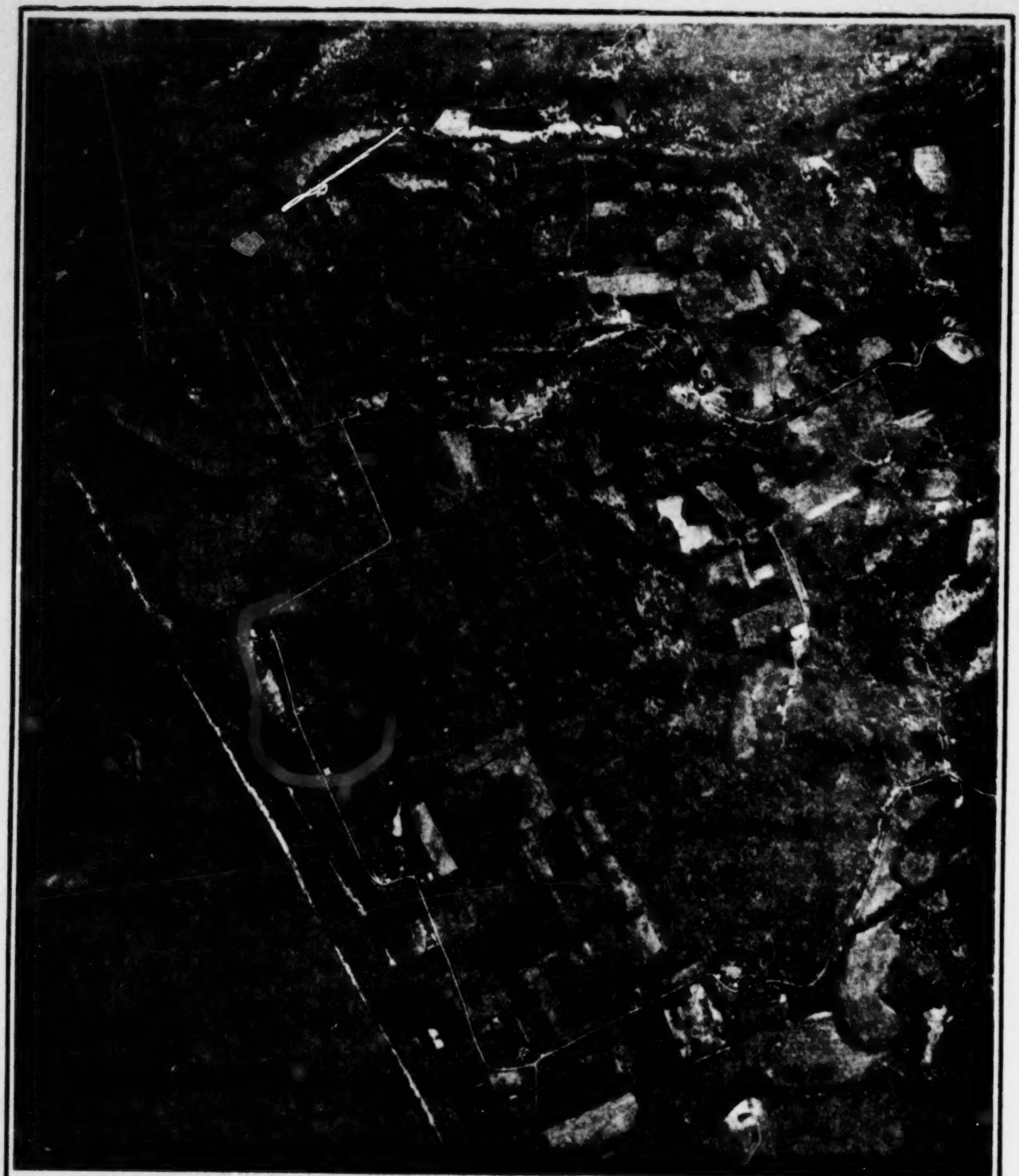
This site (Figure 3.3.3-5) is located on a low terrace of the Ohio River (River Mile 572) north of Wises Landing, Trimble County, Kentucky. It is approximately 12 miles downstream (south) from the Clifty Creek Power Plant near Madison, Indiana, and 30 miles upstream (northeast) from Louisville, Kentucky. The site is outside but in close proximity to the Applicant's service area (Quadrangle - Bethlehem Ky.-Ind., USGS 7.5 minute series).

Size, Topography, and Geology

The nearly level portion of the site comprises 620 acres. Two ravines and other adjacent upland property bring the size of the site to approximately 2,300 acres. The major part of the terrace is at an approximate elevation of 475 feet. The bluffs to the east of the site reach elevations somewhat over 800 feet; across the river, the bluffs are of similar height. Two creeks, Barebone and Corn Creeks, drain the site. Corn Creek, at the north end of the site, meanders across the flood plain before discharging into the Ohio River. Barebone Creek is at the south end of the site and flows into the Ohio River south of Wises Landing. The alluvium underlying the site is probably composed of sand and gravel with interstratified silt and clay lenses. These materials would provide adequate foundation support for plant structures.

Site Development

Barge docking facilities on the Ohio River would provide easy delivery of coal and other materials. The Ohio River would provide adequate cooling water. The site contains adequate land for development of the proposed facility, including disposal areas (the ravines) for solid waste. A 345-kV line belonging to the Applicant passes within a few hundred yards of the site on the southeast; a transmission corridor would be built from the site to tie in with the existing line. Existing roads from Bedford, Kentucky to the site would need to be upgraded. A local road on the site along the base of the bluff would have to be rerouted. Several graves on the site would have to be relocated. Corn Creek would have to be rerouted to provide space for ash disposal ponds. A berm to screen the plant from Wises Landing would be constructed and planted with trees.



Source: EROS, 1967

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TRIMBLE COUNTY GENERATING PLANT

TRIMBLE COUNTY SITE

FIGURE 3.3.3-5

Air Quality Conditions and Effects

The Trimble County site is located in the Ohio River Valley in an area where bluffs rise 300 to 350 feet on either side of the river. The bluff heights would necessitate use of very tall stacks to overcome aerodynamic downwash and plume trapping in the valley. Natural draft, wet cooling towers over 400 feet high would also be necessary to provide adequate cooling. Fogging and icing induced by the cooling tower plume may occur; however, few land uses or highways would be affected in this vicinity.

In the area of this site, ambient air quality is generally good. The existing major source of pollutants is the Clifty Creek Power Plant located approximately 10 miles north-northeast near Madison, Indiana. There were no major sources reported in 1973 in Shelby, Henry, or Trimble Counties. Total 1973 SO_2 emissions in Oldham County, Kentucky and Clark County, Indiana to the south of the Trimble County site were less than 900 tons.

Land Use - Ecology and Effects

The site has been used for agriculture, with most of the land in cultivated row crops such as corn and soybeans. Agricultural use of approximately 600 acres would be precluded by power plant development, and several residences and farm buildings would have to be removed from the site. The Corn Creek channel would be relocated where it crosses the site and the associated aquatic habitat and woodland along the stream banks destroyed. Woodlands and upland wildlife habitat in the ravines to be used for solid waste storage would also be destroyed. The economy and tax base of the area, however, would be stimulated and improved by the new plant.

Chief Advantages and Disadvantages

The site has direct access to the Ohio River for a source of cooling water and barge transportation of coal and other materials. The site also has very favorable topography and elevation; its size would allow for accommodation of all necessary plant facilities, including onsite disposal of ash and sludge. The nearly direct tie-in with the Applicant's existing 345-kV transmission line is also a distinct advantage, both in terms of reduced costs and environmental impacts, compared to building long transmission lines in new corridors.

The disadvantages of the site are the additive effects of a new source of air emissions, and the intrusion of an industrial facility into a rural area that has a high degree of aesthetic appeal. Intrusion of the proposed plant into the rural area, especially when compounded by construction of the proposed Public Service Indiana's Marble Hill nuclear plant directly across the river, would permanently affect the environment and life style of area residents. These factors--adverse effects on air quality and on rural life styles--are points of strong local opposition to a power plant at this site.

West Point Site

Location

This site (Figure 3.3.3-6) is located on the Ohio River flood plain (River Mile 631.5) in Hardin County, Kentucky due west of the community of West Point. It is bounded on the south by a Louisville and Nashville track and on the west by the Hardin-Meade County line (Quadrangle - Fort Knox, Ky., USGS 7.5 minute series).

Size, Topography, and Geology

The site is approximately 900 acres in size and is a nearly level flood plain. Site elevations are generally between 420 and 430 feet; the pool elevation in the Ohio River here is 383 feet. Bluffs as high as 700 feet occur on the west side of the site. The flood plain makes a broad loop to the south of the site for more than 2 miles; the city of West Point, east of the site, is also on low terraces of the Ohio River.

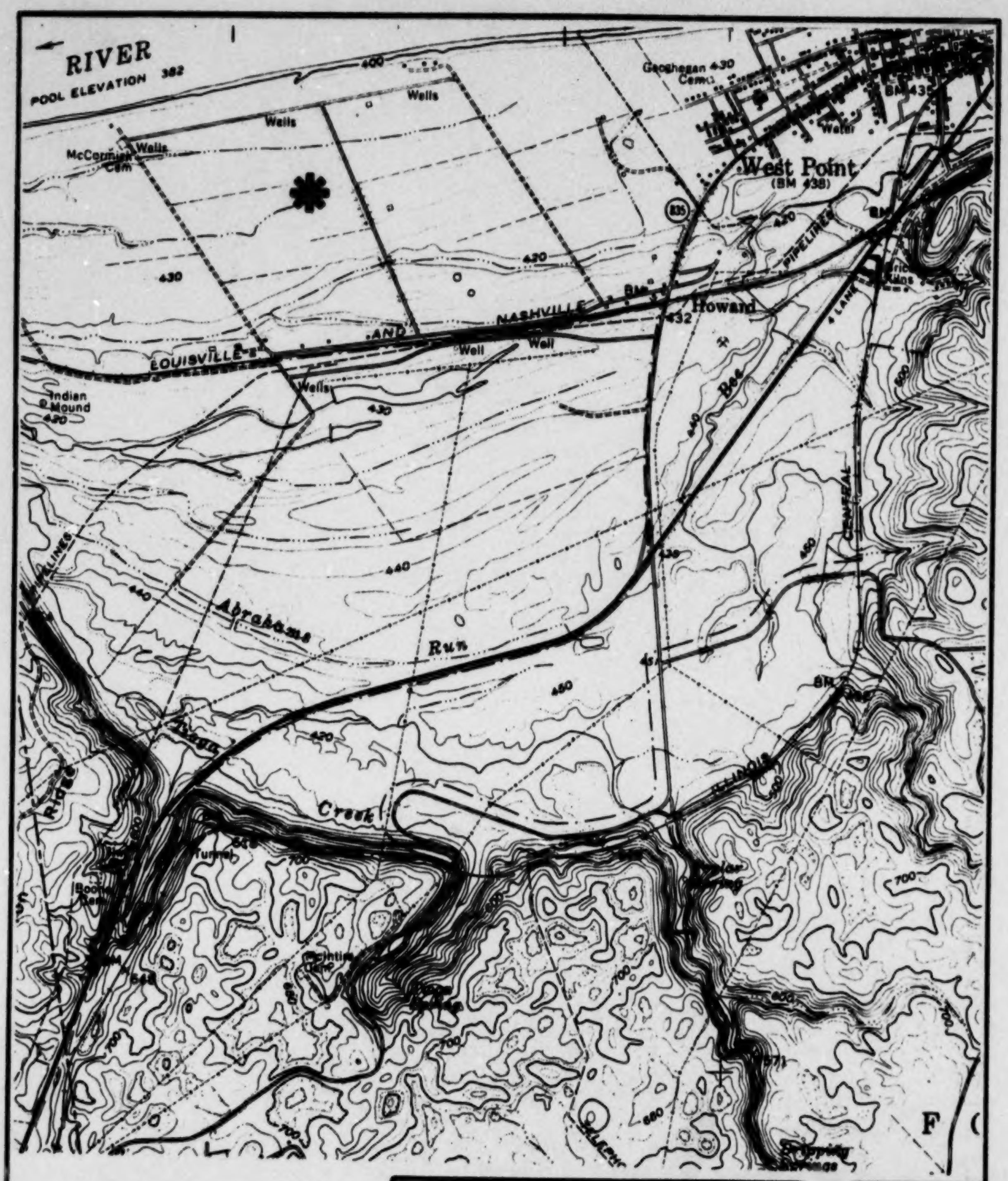
Site Development

Barge docking facilities on the Ohio River adjacent to the site would provide easy delivery of coal and other materials. Alternatively, the rail line on the south boundary of the site could provide transportation access. Highway access from State Highway 835 and U.S. 31W-60 is convenient at the southeast end of the site. The site is less than 6 miles from the Applicant's existing 345-kV loop near Mill Creek and less than 1 mile from a 154-kV line.

Because of the site's low elevation, extensive flood protection dikes and filling would probably be required. The presence of an existing water well field may interfere with site development. Little opportunity exists for onsite solid waste storage; also, the site would be a "tight fit" for all necessary plant structures and coal and limestone storage and handling facilities.

Air Quality Conditions and Effects

The West Point site is located in the Ohio River Valley and therefore subject to aerodynamic plume downwash. Consequently, a tall stack would be necessary. Sulfur dioxide and particulate emissions within 25 miles of this site are presently heavy. North-northeast from the site are the Applicant's Mill Creek, Cane Run, and Paddy's Run plants, and the Public Service Indiana New Albany plant, which together emitted over 150,000 tons of SO_2 in 1973. Roughly, an additional 30,000 tons of SO_2 are emitted from other sources within 25 miles of the site, particularly in Jefferson County. With winds predominantly from the south through west, emissions from a plant at the West Point site would compound the existing air quality problem downwind in Jefferson County. From an air quality standpoint, this is a very undesirable site.


RIVER
POOL ELEVATION 382
400
Wells
Wells
Wells
McCormick Cem
Geoghegan 430 Cem
Water
BM 435
West Point
(BM 438)
835
PIPELINES
420
430
420
LOUISVILLE & NASHVILLE
432
Howard
Well
Well
Wells
Indian Mound
420
430
Bee
440
440
Abrahams
Run
430
450
ILLINOIS
CENTRAL
4 LANE
650
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420
Creek
Ridge
Tunnel
Booth
700
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680
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571
Dripping Springs
F
-N-

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WEST POINT SITE

FIGURE 3.3.3-6

U.S. Route 31W-60, which is a rather heavily travelled highway in the vicinity of this site, could potentially be affected by fogging from cooling tower plumes, particularly that portion of the road on bluffs adjacent to the site.

Land Use - Ecology and Effects

The site is presently used for farming but the quality of land for this use is marginal. Residential and farm buildings on the site are generally of low value. The community of West Point could benefit from the economic stimulus provided by construction of a new power plant. There would be little adverse effect on land use within the site and its vicinity. The area south of the site is part of the Fort Knox Military Reservation and is largely undeveloped land with little activity that would be adversely affected by a power plant.

No important terrestrial or aquatic habitat would be directly affected by site development. A cemetery near West Point and an Indian mound near the site would be unaffected. The McCormick Cemetery on the west end of the site would possibly require removal or provision of access.

Chief Advantages and Disadvantages

The chief advantages of this site are excellent access by barge, rail, and highway and availability of cooling water from the Ohio River. It is near the Applicant's existing high voltage transmission grid and the Louisville load center (however, because of existing Applicant plants only a few miles away, it may not be well situated from a system balance viewpoint). Other advantages are that little direct disruption of high value land uses and existing residences would occur, and also that the topography and foundation conditions are generally favorable.

The most serious disadvantage, and possibly a prohibitive constraint on a power plant at this site, would be the addition of more air emissions in an area already having several large sources of particulate and sulfur dioxide emissions. Other disadvantages are the lack of solid waste disposal areas on the site, site wetness and flooding hazards, and limited size (and, therefore, flexibility in plant layout) of the site.

Westport Site

Location

This site (Figure 3.3.3-7) is located on the Ohio River flood plain (River Mile 579) in Oldham County, Kentucky, approximately 25 miles upstream from Louisville, Kentucky. The small community of Westport is located at the south end of the site (Quadrangle - LaGrange, Ky.-Ind., USGS 7.5 minute series).

Size, Topography, and Geology

The site comprises a little over 500 acres. It is an alluvial terrace with elevations generally ranging from 450 to 480 feet. The normal pool elevation of the Ohio River at this point is 420 feet. The plant grade would be well above the highest recorded flood stage. Bluffs adjacent to the site rise approximately 750 feet. Circle Dart Lake, a small impoundment of 5 to 10 acres, lies at the northeast end of the site. A small intermittent drainageway heads up on the site and empties into Eighteenmile Creek south of Westport. Alluvial deposits would provide adequate support for power plant foundations.

Site Development

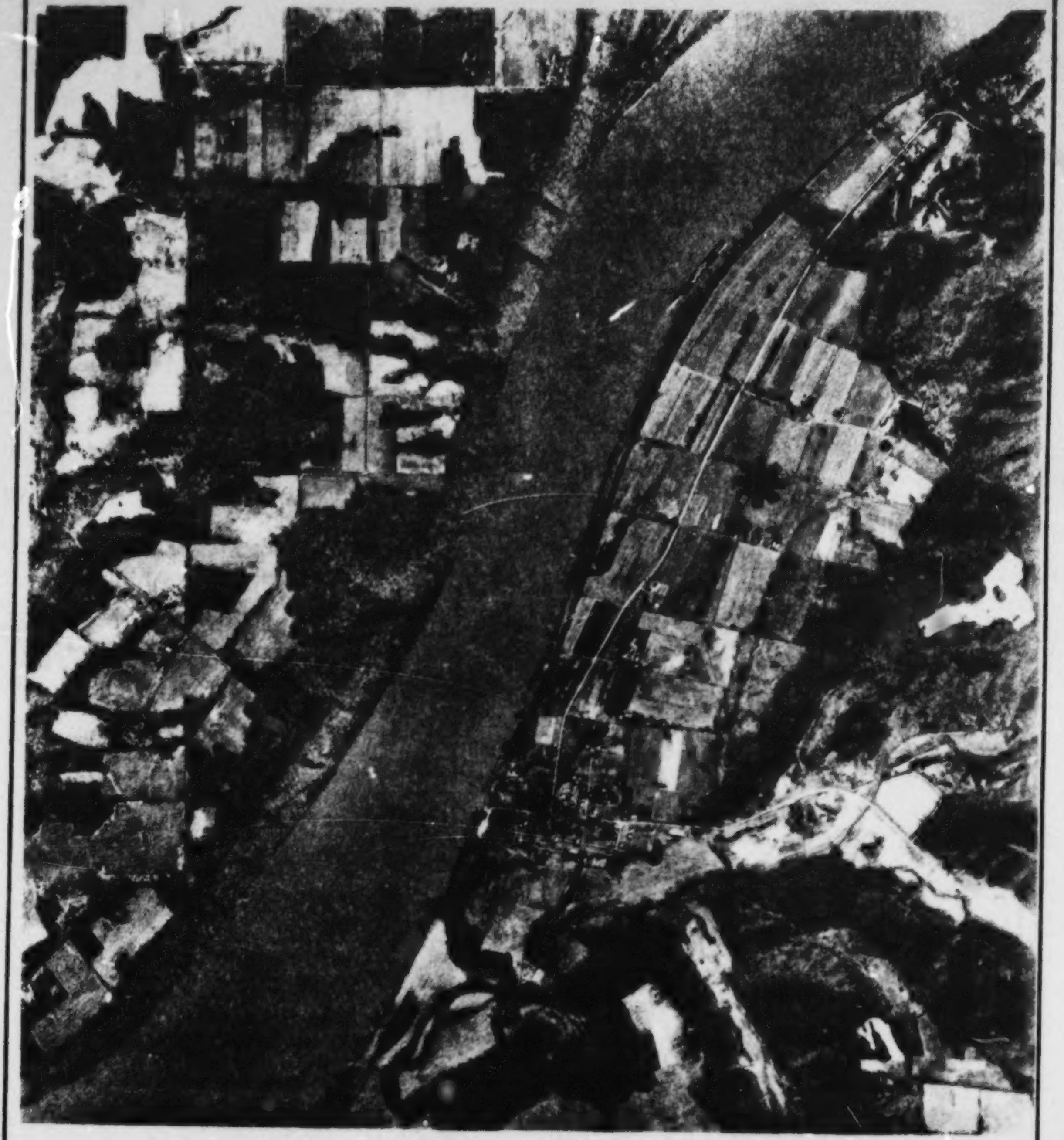
The site offers direct access for barging of coal and other materials on the Ohio River. Also, the Ohio River would supply makeup water to the plant. Because the site is small, location of solid waste storage areas onsite would be a problem. Highway access to the site is provided by State Highway 524 from U.S. 42. The Applicant's 345-kV transmission line between Clifty Creek Power Plant and Louisville passes within 10 miles east of the site. The site has favorable elevation and relief for site preparation, and the plant would not require extensive flood protection works.

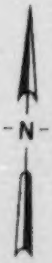
Air Quality Conditions and Effects

Bluffs 300 feet high occur on either side of the river. The consequent potential for aerodynamic downwash and the necessity of a tall stack to carry effluents well out of the valley are disadvantages. The nearest major source of SO_2 is the Clifty Creek Power Plant in Madison, Indiana 16 miles to the north-northeast. Total 1973 SO_2 emissions from this facility were approximately 47,700 tons. Sulfur dioxide emissions from point sources in Oldham County and all neighboring counties, with the exception of Jefferson County to the southwest, totalled less than 900 tons in 1973. Air quality in the vicinity of the site is good, with pollutant concentrations generally below the secondary standards. Predominant south through west winds in the region would often carry plant effluents away from the Louisville and Jefferson County areas. Since this location is in a valley, there is a potential for cooling tower-induced fogging and icing on the highway and structures, particularly on bluffs adjacent to the site.

Land Use - Ecology and Effects

The main portion of the site has been used for agriculture. The community of Westport has some 80 houses and is a base for a great deal of pleasure boating on the Ohio River. Besides the cluster of homes in Westport, a number of people reside along Covington Ridge Road, which parallels the terrace face through the site. No important terrestrial or aquatic habitat would be directly destroyed by site development. Construction of new transmission lines for a distance of 10 miles across wooded, rolling topography would have adverse impacts on terrestrial habitat and aesthetics





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TRIMBLE COUNTY GENERATING PLANT

WESTPORT SITE

FIGURE 3.3.3-7

and could interfere with some land uses. Also, development of an adequate solid waste storage site is probably not feasible on the site; therefore, these wastes would have to be transported from the site to another disposal area. Whether wastes were moved overland or by barge, there would probably be some adverse environmental impacts.

Chief Advantages and Disadvantages

The chief advantages are direct access to Ohio River water and barge transportation, favorable site elevation and foundation conditions, and proximity to the Louisville load center.

A disadvantage is the small site size, which would limit site layout opportunities and probably would necessitate transport of solid wastes to a disposal area away from the site. The need for tall stacks and potential cooling tower-induced fogging and icing are also disadvantages associated with the river valley location. The proximity to Westport and the necessity of relocating several homes is disruptive to the area and also constitutes a disadvantage. The 10-mile new transmission corridor would have some adverse effects on local land use and aesthetics.

3.3.4 Alternative Sites Comparison

Of the siting criteria discussed in Section 3.3.2, five were picked as major limiting factors and used to compare and evaluate the alternative sites: (1) air quality--the plant must be able to meet applicable air quality standards; (2) water--site must be near an adequate source of cooling water; (3) size--land must be large enough to contain a 2,400 MWe plant (including 60,000 acre-feet of storage for solid waste); (4) proximity--site must be near existing Louisville Gas and Electric Company transmission grid, load facilities, and coal transportation facilities; and (5) compatibility--plant must be compatible with the natural and human environment.

A sixth criterion, related to the nature of the Applicant's service area, was also included in the evaluation of the seven candidate sites. The northern portion of the Applicant's service area is presently experiencing the fastest growth rate and will therefore require a large portion of the power generated by the proposed project. In order to meet the increased power demand of this area, it would be preferable to locate the proposed project near the growth area, for two reasons. One, large distances between the generating station and the ultimate delivery point for the power it generates mean voltage reductions as the power is transmitted. This results in higher operating costs. Second, locating the proposed project in the southern portion of the service area would mean that the Applicant would be more dependent on outside help, should a major transmission line outage occur between the Applicant's present generating stations (most of which are in southern area) and the eastern portion of the service area. The Applicant's goal is to develop a balanced system configuration, as this results in the most reliable and cost-effective delivery of power throughout the system.

Table 3.3.4-1 is a descriptive matrix of the sites; it is, in essence, a summary of Section 3.3.3.

Of the seven sites evaluated, the Trimble County site was selected as the preferred alternative on the basis of the following factors: (1) ample acreage available for plant siting and solid waste disposal; (2) easy access to cooling water supply and barge transportation; (3) nearness to transmission line tie-in; (4) low SO_2 concentrations in the area; and (5) a location in the northern portion of the Applicant's service area. Also, when the site was selected, it did not appear to have any unique ecological characteristics, although this was not found to be the case after the environmental studies of the site were conducted. Hampton Creek is nearly as good a site as the preferred site, but is more costly because longer transmission lines would have to be constructed. Also, the Hampton Creek site is probably less apt to be accepted by the public because of its location in a more densely populated area. Further, it is located near other major operating coal-fired plants. Additionally, it is possible that another utility will have first claim on this area. The Westport site is quite similar to the Trimble County site but is significantly more distant from the 345-kV transmission system. It has the further disadvantage of lacking a good opportunity for onsite solid waste storage. Because Westport is a community with evidence of new residential growth, more people would be affected by site development, and a power plant located there would be less compatible with future land use.

The LaGrange site is considerably less favorable than the previous three sites because of the expected very high costs of site development. Extensive site grading, including rock excavation, special foundation treatment such as grouting, construction of makeup water and blowdown pipelines, and construction of a rail spur for several miles would be involved in developing the LaGrange site. The LaGrange site would be free of some of the environmental impacts associated with a valley location, but these gains would be more than offset by the impacts of pipeline and rail construction. It is believed that the overall environmental costs would be appreciably greater than those of plant development at the Trimble County, Hampton Creek, or Westport sites. It is clear that the economic costs of developing the LaGrange site would be substantially greater.

The remaining three sites, Brandenburg, West Point, and Garrett, are located southeast of Louisville. Each possesses several important disadvantages. Space limitations may prevent the development of a four-unit, 2,400-MWe facility at the Brandenburg and West Point sites. In the case of the Garrett site, only detailed subsurface exploration will determine whether the site is technically feasible with respect to the integrity of foundations in this sinkhole area. The expenditures of large amounts of capital could, no doubt, correct many of the deficiencies of these sites, but even so, no significant savings in environmental costs would be achieved compared to the four sites northeast of Louisville. All three sites have the disadvantage of being in the southern portion of the Applicant's service area (see previous discussion of the preferability of a northern location).

The chief advantage of the three southeastern sites is that they will be more acceptable to the public than the northern sites.

TABLE 3.3.4-1

ALTERNATIVE SITES SUMMARY MATRIX

Site	LOCATION		SIZE, TOPOGRAPHY, AND GEOLOGY		SITE DEVELOPMENT	
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
BRANDENBURG	On flood plain; consequently, advantageous for cooling water access and barge transportation. Access to Louisville load center. Access to Louisville & Nashville rail line for alternate transportation.	Near Olin Corporation Doe Run plant, so that emissions may be additive. Also located so that prevailing winds may carry SO_2 emissions into Jefferson County, an AQC maintenance area.	From 700-800 acres of nearly level land. Good drainage. Unconsolidated alluvial sediments adequate for plant foundations.	Topography (partially valley along Flippins Run) somewhat conducive to cooling tower-induced fogging and icing. Site is somewhat small for 2,400-MWe facility: there is not adequate space for the desired 60,000 acre-foot solid waste storage area. Bluffs rising 200 ft on each side of river are potential cause of aerodynamic plume downwash and may create necessity for tall stacks.	Advantageous with respect to availability of cooling water and barge docking facilities to allow transport of construction materials, plant components, coal fuel. Alternate rail transportation also available. Good highway access by State Highway 933 or improvements to the "Ohio River Trail" road.	13 miles from nearest poi 345-kV grid. Some difficult routing, b a direct transmission line would cross Ohio River and through Indiana. No solid waste storage are desired size.
GARRETT	The site is an upland location and therefore provides good ventilation.	Site is almost 5 miles from the river, so all materials would have to be transported by rail and cooling water conveyed by pumping. Also disadvantageous is the distance to the nearest point on the 345-kV transmission line - 16 miles.	From 800-900 acres available for development.	Topography and geology highly disadvantageous because of karst terrain and underlying Mississippian limestones, which are subject to solution weathering. Weathering could lead to problems with foundation support, integrity of water reservoirs, and possible ground water contamination from coal pile and solid waste storage areas.	Elevation is advantageous in that shorter (less expensive) stacks can be used.	Development costs likely t very high due to location from river (necessity of b ing a rail spur, a pump ho and a line for conveyance cooling water, and a water storage reservoir); distan from existing kV line (16 karst topography (difficul obtaining sound foundation rolling topography (requir of extensive grading).
HAMPTON CREEK	Because this site is on the river, access to cooling water and barge facilities is good. Site is less than 50 miles from Louisville. Good access to Applicant's 345-kV line. Near the growth area of the Applicant's service area.	Proximity to Kentucky Route 36, which is heavily travelled, may cause public opposition. The fact that the site is not in the service area might also increase opposition, particularly if American Electric Power Company actively pursues their interest in a tract of land near the site.	Good site size, with 1,000-1,200 acres of nearly level or gently sloping land available. Site has excellent drainage and would be free from flood hazards (site is a high river terrace). Site offers good foundation conditions (probably alluvial sands and gravels) for plant structures.	Bluffs on either side of river (400-450 high) would necessitate use of very tall stacks to overcome plume downwash and trapping in the valley.	Costs would be comparatively low because of location near river and highly favorable topography and soil conditions, which factors allow for: direct access to cooling water and barge transport; good drainage; and good foundation conditions. Size and levelness also cut costs. Kentucky 36 provides easy access to site.	Coal would have to be conve over or under Kentucky 36, is heavily travelled and d populated.
LAGRANGE	Location is within 2 miles of 345-kV line. Location is upland, which makes it favorable for ventilation; consequently air quality problems and stack construction costs are reduced. Near the growth area of the Applicant's service area.	Location is 4 miles inland from Ohio River, so that rail transport and pumping facilities would have to be constructed for water and material supplies.		Although the site contains over 600 acres that could be developed only 300 acres are of gentle topography. This size would be somewhat limiting, and the site would require extensive preparation. Solution weathering phenomena at site may cause problems in reservoir construction and make it difficult to achieve stable foundations for plant structures.	Transmission line could easily be run into 345-kV line 2 miles from site.	Costs would be high because the rough terrain and possi extensive solution-channeli of underlying rocks, partic larly since large-scale gr may be required for foundat and for the dam of the emer water reservoir. Solution channeling would also make difficult to protect the gr water resource of the area leakage from the reservoir ash storage pond. Construction of the necess rail spur over 5 miles of r terrain would also be costly Besides the high initial ca costs, there would be high annual costs associated with pumping water over substanti height and distance.

TABLE 3.3.4-1

ALTERNATIVE SITES SUMMARY MATRIX

	SITE DEVELOPMENT		AIR QUALITY CONDITIONS AND EFFECTS		LAND USE - ECOLOGY AND EFFECTS	
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
valley what wer- ng. for here for the solid each ntial ume neces-	Advantagequs with respect to availability of cooling water and barge docking facilities to allow transport of construction materials, plant components, coal fuel. Alternate rail transportation also available. Good highway access by State Highway 933 or improvements to the "Ohio River Trail" road.	13 miles from nearest point on 345-kV grid. Some difficult routing, because a direct transmission line route would cross Ohio River and go through Indiana. No solid waste storage area of desired size.		Potential aerodynamic plume downwash and possible need for tall stacks because of bluff heights. Other nearby SO_2 emission sources (Olin Corporation's Doe Run plant, Applicant's Mill Creek plant, Kentucky Solite Corporation's plant) would be additive. In Jefferson County, where SO_2 already exceeds primary standards, easterly winds could cause cooling tower and stack drift to affect Brandenburg Potential for cooling tower-induced fogging and icing on highways and structures. Winds from southwest-west (19% of time annually) would carry effluent into Jefferson County, which already has SO_2 concentrations in excess of primary ambient air standard.	Major portion of site is free of buildings and is in farmland, so that few natural important terrestrial or aquatic habitats are likely to be present in development area. Area would derive economic benefits from plant development.	A bluff area along Flippins R.- may harbor endangered plant species. Development at east end of site (Olin Corporation's Doe Run plant) and a residential-estate type development to the southeast are likely to increase probability of public opposition. Public opposition highly likely because of potential impairment of air quality.
highly of karst Mississip- are sub- ring. problems , integ- , and ntami- solid	Elevation is advantageous in that shorter (less expensive) stacks can be used.	Development costs likely to be very high due to location away from river (necessity of building a rail spur, a pump head and a line for conveyance of cooling water, and a water storage reservoir); distance from existing kV line (16 miles); karst topography (difficulty in obtaining sound foundations); and rolling topography (requirement of extensive grading).	Diffusion characteristics of an upland site make use of shorter stacks possible and reduce probability of cooling tower-induced fogging and icing on nearby roads and structures.		Since most land is in idle oldfield or low-intensity agriculture, site development would not be likely to have adverse effects on terrestrial ecology.	A transmission line (not Applicant's) crosses the site.
river ecessitate to over- trapping	Costs would be comparatively low because of location near river and highly favorable topography and soil conditions, which factors allow for: direct access to cooling water and barge transport; good drainage; and good foundation conditions. Size and levelness also cut costs. Kentucky 36 provides easy access to site.	Coal would have to be conveyed over or under Kentucky 36, which is heavily travelled and densely populated.	Ambient air quality is good, with concentrations generally below the secondary ambient air quality standards. Only two other major sources of SO_2 are in area, and prevailing winds generally would not be conducive to interaction of plumes from proposed plant with these.	Very high (400-450 foot) bluffs on either side of the river would necessitate use of very tall stacks to overcome aerodynamic plume downwash and trapping in valley. Winds from east or west would cause ground level concentrations of the proposed plant to be additive. Kentucky 36 and Indiana 56, which run parallel to the river near the site, might be subject to fog induced by cooling towers. Bluffs adjacent to site would be subject to fogging.	because the area is fully cleared, there would be few impacts on area wildlife because no natural habitat would be destroyed.	Site development would preclude present agricultural land use (land is prime agricultural land). There are residences along Kentucky 36 that, though not necessarily requiring relocation, would be impacted by plant operation. Negative aesthetic effects on an area heavily travelled and densely populated would cause a great deal of public opposition.
ine over developed ntle would be he site prepa- omena e in nd make stable ructures.	Transmission line could easily be run into 345-kV line 2 miles from site.	Costs would be high because of the rough terrain and possible extensive solution-channeling of underlying rocks, particularly since large-scale grouting may be required for foundations and for the dam of the emergency water reservoir. Solution channeling would also make it difficult to protect the ground water resource of the area from leakage from the reservoir and ash storage pond. Construction of the necessary rail spur over 5 miles of rough terrain would also be costly. Besides the high initial capital costs, therp would be high annual costs associated with pumping water over substantial height and distance.	Since site is high upland, its diffusion characteristics are such that stack heights over 700 feet may not be necessary. Air quality in vicinity is presently good, with pollutant concentrations generally below the secondary standards. SO_2 emissions in the area for 1973 were comparatively low, with only one major source within 20 miles of the site. The prevailing winds are south through west, which would carry effluent away from the Louisville and Jefferson County areas. Because site elevation is comparatively high, cooling tower-induced fogging and icing on nearby roads and structures would be avoided.		As site is used for crops and grazing, no unique habitats would be newly disrupted.	At least five residences would be affected by site development. Wildlife habitat in ravines and creek bottoms would be adversely affected. Siltation and runoff from site could adversely affect Harrod's Creek unless protective measures were employed. Two orchards on the east end of the site would be disrupted or destroyed.

TABLE 3.3.4-1 (Continued)

Site	LOCATION		SIZE, TOPOGRAPHY, AND GEOLOGY		SITE DEVELOPMENT	
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
TRIMBLE COUNTY	Location on the Ohio River allows easy access to cooling water supply and barge facilities. Site is located only a few hundred yards from 345-kV line. Near the growth area of the Applicant's service area.	Site is in an area of high rural aesthetic appeal, and is also directly across the river from the proposed PSI Marble Hill nuclear plant. There would be strong local public opposition to construction and operation of another facility in this area.	Size and topography distinctly advantageous: over 2,300 acres could be developed, including two ravines highly suitable for solid waste disposal areas; 600 acres are nearly level, and provide adequate land for development of proposed facility. Site has good drainage. Alluvium underlying the site is probably sand and gravel with interstratified silt and clay lenses; these materials would provide adequate foundation support for plant structures.	The 300- to 350-foot bluffs on either side of the river at the site would necessitate use of very tall stacks to overcome aerodynamic downwash and plume trapping in the valley.	Barge docking facilities on Ohio River provide easy delivery of coal and other materials. Proximity to the river allows low-cost access to cooling water supply. The ravines are especially advantageous for development as solid waste disposal areas. Applicant's 345-kV line passes within a few hundred yards of site; the transmission corridor required would therefore be short (consequently, less costly and less disruptive environmentally).	Some costs would be inc in road upgrading and relocations: roads from Bedford, Kentucky to the would have to be upgrad and a local road on the along the base of the bl would have to be rerouted Corn Creek would have to rerouted to provide spac for ash disposal ponds. Several graves on the si would have to be relocat
WEST POINT	Location on flood plain affords easy access to cooling water supply and barge facilities. Site is located advantageously with respect to rail and highway access and within 6 miles from Applicant's 345-kV line.	Flood plain and low elevation makes site subject to plume downwash and also to flooding hazards. Area already receives heavy SO_2 and particulate emissions.	Site offers 900 acres of nearly level flood plain, with soil conditions suitable for plant development.	Area is low and therefore subject to flooding and soil wetness. The site offers no areas suitable for solid waste disposal, and its size would allow little flexibility in plant layout. The necessary plant structures and coal and limestone storage and handling facilities would be an extremely "tight fit" on this site.	All transport access very good: barge docking facilities on the Ohio River would provide easy delivery of coal and other materials. A rail line on the south end of site is good transport alternative. Good highway access from State Highway 835 and U.S. 31W-60 at southeast end of site. Site is less than 6 miles from 345-kV line and less than 1 mile from an existing 154-kV line.	Extensive flood protec and filling would prob required because of low tion. An existing water well may interfere with devel There are no areas suit onsite solid waste stor
WESTPORT	Flood plain location allows direct access to river for cooling water supply and barge facilities. Site is less than 25 miles from Louisville load center. Near the growth area of the Applicant's service area.	Site is very close to Westport. Valley locations would require use of tall stacks to overcome aerodynamic downwash; location also makes potential cooling tower-induced fogging and icing a problem for nearby highway and structures.	The site has good drainage and alluvial deposits that would provide adequate support for power plant foundations. Its elevation is favorable; the plant grade would be well above the highest recorded flood stage.	Bluffs 300 feet high on either side of river would require use of tall stacks. The site is small (a little over 500 acres), which would limit site layout flexibility and probably necessitate transport of solid wastes offsite.	Site offers direct access for barging of coal and other materials, and a supply of cooling water. Good highway access is provided by State Highway 524 from U.S. 42. Site is less than 10 miles from Applicant's 345-kV line. Elevation and relief are favorable for development (no extensive flood protection works would be needed).	Site is small, and locat solid waste storage ar would be problematical, impossible.

TABLE 3.3.4-1 (Continued)

	SITE DEVELOPMENT		AIR QUALITY CONDITIONS AND EFFECTS		LAND USE - ECOLOGY AND EFFECTS	
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
s on t the of plume	Barge docking facilities on Ohio River provide easy delivery of coal and other materials. Proximity to the river allows low-cost access to cooling water supply. The ravines are especially advantageous for development as solid waste disposal areas. Applicant's 345-kV line passes within a few hundred yards of site; the transmission corridor required would therefore be short (consequently, less costly and less disruptive environmentally).	Some costs would be incurred in road upgrading and some relocations: roads from Bedford, Kentucky to the site would have to be upgraded, and a local road on the site along the base of the bluff would have to be rerouted. Corn Creek would have to be rerouted to provide space for ash disposal ponds. Several graves on the site would have to be relocated.	Ambient air quality in the site area is generally good, with only one major source of pollutants 10 miles northeast (Clifty Creek Power Plant). SO_2 emissions for 1973 in the area were low.	Since plant site is in valley with 300- to 350-foot bluffs on either side, very tall stacks would be required to overcome aerodynamic downwash and plume trapping in the valley. Fogging and icing may occur, though they would have little effect on land uses or roads in the vicinity. Emissions would be additive with PSI Marble Hill plant across the river.	The economy and tax base of the area would be stimulated and improved by plant development.	Agricultural use of 600-700 acres would be precluded by plant development. Several residences and farm buildings would have to be removed from the site. The relocation of the Corn Creek channel will involve destruction of the associated aquatic habitat and woodland along the stream banks. A valuable wetland area would also be affected. Woodlands and upland wildlife habitat in the ravines would also be destroyed. Because site is currently a very attractive rural area, public opposition to a power facility would be great, particularly since PSI is seeking to locate their proposed Marble Hill nuclear plant directly across the river. Presence of these facilities would permanently affect life style and air quality in the area.
sub- suit- posal, little t. ctures torage would c" on	All transport access very good: barge docking facilities on the Ohio River would provide easy delivery of coal and other materials. A rail line on the south end of si[illegible] is good transport alternative[illegible]d highway access from Stat[illegible]ay 835 and U.S. 31W-60 at [illegible] end of site. Site is less than 6 miles from 345-kV line and less than 1 mile from an existing 154-kV line.	Extensive flood protection dikes and filling would probably be required because of low elevation. An existing water well field may interfere with development. There are no areas suitable for onsite solid waste storage.		Location in river valley makes site subject to aerodynamic plume downwash, requiring tall stacks. SO_2 and particulate emissions within 25 miles of site are presently heavy (Applicant's Mill Creek, Cane Run and Paddy's Run plants, and PSI New Albany plant). Prevailing winds (south through west) would compound existing air quality problems downwind in Jefferson County. U.S. 31W-60, a heavily travelled road in the site vicinity, could be affected by fogging from cooling tower plumes.	Plant development would provide beneficial economic stimulus to community of West Point. Use of land would have very little adverse effect because quality of land is only marginal for farming; existing residences are low-value; area south is part of Fort Knox and is therefore largely undeveloped with nothing to disturb.	
ither ire le over limit and nsport	Site offers direct access for barging of coal and other materials, and a supply of cooling water. Good highway access is provided by State Highway 524 from U.S. 42. Site is less than 10 miles from Applicant's 345-kV line. Elevation and relief are favorable for development (no extensive flood protection works would be needed).	Site is small, and locations of solid waste storage areas onsite would be problematical, maybe impossible.	Air quality in site vicinity is good, with pollutant concentrations generally below secondary standards. SO_2 emissions in area are not heavy, and the nearest major source (Clifty Creek Power Plant) is 16 miles to the north-northeast. Because predominant wind direction is south through west, plant effluents would generally be carried away from Louisville and Jefferson County.	Bluffs would create potential for plume downwash, necessitating use of tall stacks. Cooling tower-induced fogging and icing may occur on highway and local structures, particularly on the bluffs adjacent to the site.	Site has been used for agriculture, so that no important terrestrial or aquatic habitat would be directly destroyed by site development.	Community of Westport contains approximately 80 houses and is a base for Ohio River pleasure boating. There are also residences along Covington Ridge Road, which runs through the site. The necessity to relocate some of these homes would be disruptive and would meet with strong public opposition. Construction of new transmission line for 10 miles across woods and rolling topography would adversely impact terrestrial habitat as well as area aesthetics, and may interfere with some land uses. Transport of solid waste offsite, either overland or by barge, would cause some adverse environmental impacts.

3.4 ALTERNATIVE PLANT SYSTEMS

The following subsections consider plant systems that would be alternatives for the Trimble County site, which is the Applicant's preferred site (see Section 3.5.1). Section 3.5.2 compares the various systems discussed and identifies the preferred alternatives.

3.4.1 Alternative Waste Heat Rejection Systems

Introduction

Thermodynamically, it is not possible during electrical energy production to use all the heat energy transported in steam to produce electrical energy. This waste heat must be dissipated as the plant operates. It can be dissipated to a natural body of water which, through natural circulation and evaporation, will dissipate the heat slowly to the atmosphere. Or it can be dissipated directly to the atmosphere at evaporation rates greatly increased by man-made means.

For the proposed station, the following criteria were established for selection of a heat rejection system:

1. The heat rejection system should be capable of rejecting the waste heat from the planned four units
2. The heat rejection system should comply with federal (EPA) and state regulations
3. The heat rejection system should not adversely affect the reliability and availability of the planned station
4. The heat rejection system should not impair the ability of the station's units to operate at maximum design capacity under more than 1 percent of the observed summer ambient conditions

Historically, when central station power plants were located near large natural bodies of water, such as the Ohio River, water was circulated from the source through the plant to remove waste heat, and the heated water was then discharged directly to the source. This method of heat rejection is called "once-through cooling."

Two main problems exist with once-through cooling. The method tends to cause localized changes in the temperature distribution of the source of water. Further, in order to most effectively remove waste heat, relatively high ambient source water temperatures need to be artifically lowered. In both these cases, the historical approach has been to provide cooling towers which transfer some of the waste heat load directly to the atmosphere. This is called a "helper cycle."

Both of these approaches are no longer considered environmentally desirable, and this is presently reflected in federal and state regulations. Therefore, because they violate the second criterion, these methods were not considered further.

The other approaches to heat rejection available after ruling out once-through cooling and helper cycles are broadly classified as closed-cycle systems. This implies that the waste heat is not rejected to the source body of water. These systems all rely on heat rejection to the atmosphere. The most common method utilized is evaporative cooling, although some tentatively proposed methods function in a manner similar to an automobile radiator.

The closed-cycle systems examined were:

1. Man-made lakes
2. Spray assisted man-made lakes
3. Cooling towers
    a. Dry cooling
    b. Mechanical draft
    c. Wet/dry mechanical draft
    d. Natural draft

Man-Made Lakes

In this alternative, an artificial lake is created to serve as a source of cooling water for the plant. The cooling water is circulated through the plant and the lake. The waste heat transferred to the cooling water is removed from the lake through evaporation. The size of the lake is determined by the amount of surface area required for evaporation of the waste heat and cooling of the lake's water to a temperature that is, first, satisfactory for existing technology and, second, economical for plant operation.

In the case of the proposed station, a man-made lake would require a surface area of at least 2,340 acres and ideally 11,700 acres.

Spray Ponds or Canals

In some areas where a limitation on available land is a constraint, a long canal or pond is constructed. Across the width of the canal at set intervals are located distribution pipes with spray modules. The cooling water is distributed throughout the spray system. The spray modules, through "atomization" of the cooling water as it is sprayed, serve to increase the effective evaporative surface of the water and the wind evaporative effect.

Such a system for the proposed station would require approximately 100 acres and 320 spray modules. These systems tend to cause local fogging. They have not seen significant use in geographic and meteorological areas similar to Trimble County.

Cooling Towers

Generally, cooling towers are devices which, by means of either mechanical and/or chimney effects, induce high air flow rates to pass through films of plant cooling water, causing evaporation and waste heat removal to the atmosphere. There are also types which rely primarily or partially on convective heat transfer (the type of heat transfer that occurs in automobile radiators). Historically, cooling towers were used only in locations where water was scarce, the source-body small, or the source-body ambient temperature high.

Dry Cooling Towers

This method of cooling tower design and function was created to eliminate evaporation losses of cooling water in regions where water is very scarce. It is strictly a convective system. The water is circulated through tubes which are exposed to a high air flow induced by motor driven fans.

Because the heat transfer process in this design is based on non-evaporative means, the normal cooling water temperature after waste heat rejection is high. This causes the turbine to exhaust at high temperatures and high pressures; this is inefficient for cycle operation. Further, domestic turbine vendors restrict their turbine exhaust pressures to values below those economically achievable with present dry tower design.

Mechanical Draft Tower

This type of tower achieves its cooling primarily by evaporation. A system of fans induces a high air flow through the towers. The cooling water, after extracting the plant's waste heat, is dispersed through a baffle system in the tower called fill. This separates the water into many film-like layers, causing a great increase in evaporative surface.

There are two physical types of mechanical draft towers: rectangular and round. The round towers require less plant site area for equivalent cooling. They also have better plume (vapor laden air) rise and, thus, dispersion characteristics. This is important, as the rectangular towers cause significant ground level fogging and icing. In spite of a higher initial cost, the round mechanical draft towers would be preferable at the proposed plant on two counts. First, less near-plant site space is required, and, second, the environmental effect potential (with respect to drift and solids deposition from the plume) is less.

Wet/Dry Mechanical Draft Tower

This type of tower was developed as a compromise between the two previously described tower types. It helps minimize water consumption by limiting evaporation to the wet section and it allows attainment of turbine back pressures acceptable to domestic turbine vendors. This tower type has a higher initial cost than the round mechanical draft tower and is more expensive to operate. Experience with this tower type is quite limited.

Hyperbolic Natural Draft Towers

This cooling tower type functions similarly to the mechanical draft; however, the driving force causing high air flow through the fill is the chimney effect. The chimney effect is caused because of the density difference between the warm, waste-heat-laden air and the cooler ambient air outside the tower.

The overriding advantage of this tower type is its ability to disperse the plume at a very great elevation compared to the other tower types. Additionally, the trapping (entrainment) of water droplets in the air is minimized.

This tower type has the greatest size. The stack height is close to 500 feet and the base diameter 350 feet; the chimney outlet is 200 feet in diameter. It does not, however, require more site area than the other tower types.

This tower type has a higher initial cost than all the other tower types, but its operating cost is generally lower than the others.

3.4.2 Alternative Atmospheric Pollution Control Systems

Sulfur Dioxide Control Alternatives

Sulfur dioxide emissions from a coal-fired power plant can be controlled by the following methods. They may be used singly or in combination.

1. Removal of sulfur from the coal before combustion (coal beneficiation)
2. Combustion of: (a) coal with a low sulfur content, or (b) solvent-refined coal
3. Switching from high sulfur to low sulfur coal when adverse conditions exist, or switching the electrical load to another generating facility (dynamic or intermittent control)
4. Removal of SO_2 from flue gases before these are discharged from the stacks (flue gas desulfurization, or FGD)

Combustion of low sulfur coal either intermittently or regularly does not require any special design or process. Therefore, the following paragraphs will only describe the processes involved in Alternatives 1, 2(b), and 4.

Coal Beneficiation

Coal beneficiation can be done mechanically, magnetically, or chemically. In the mechanical washing process, the sulfur-containing mineral, pyrite, is separated from the coal, usually at the mine site. The use of this method depends on the availability of sufficient water near the mine. The magnetic separation method is still undergoing laboratory testing, and the existing chemical separation procedure is not feasible because of the lead time required for further development and testing. Coal for the proposed plant may be beneficiated by the mechanical method; however, most beneficiated coal would not meet existing emission standards without other control methods to supplement the beneficiated coal.

Solvent-Refined Coal

Solvent-refined coal, although low in ash and sulfur, is still in the development stage. It is very expensive and not available in sufficient quantity for use in the proposed project.

Flue Gas Desulfurization

Flue gas desulfurization is a developing technology. Many processes are currently being evaluated in pilot or demonstration plants; others are still undergoing laboratory testing. In general, flue gas desulfurization systems can be divided into two groups: (1) throwaway processes, in which the end product is a waste that requires disposal, and (2) recovery processes, in which one or more marketable products are recovered--the additive or scrubber effluent, a sulfur product, or both.

Throwaway Processes. These generally have lower capital costs than recovery processes, but they require space for sludge disposal, and they also present potential water pollution problems. Current research on use of sludge in construction materials and other products may alleviate this drawback. Throwaway methods currently available are of a type known as nonregenerative alkali scrubbing. They include wet lime scrubbing, wet limestone scrubbing, and dual alkali scrubbing.

1. Wet Lime Scrubbing and Wet Limestone Scrubbing - In wet lime scrubbing, a slaked lime slurry is introduced into the flue gas scrubbing equipment; in wet limestone scrubbing, a pulverized limestone slurry is used in place of the lime. Some scaling or plugging may occur in the scrubber, but methods have been developed to minimize these problems. Both lime and limestone scrubbing result in an insoluble waste product, calcium sulfite/calcium sulfate. The lime/limestone processes are the least expensive and most reliable FGD processes now in operation

2. Dual Alkali Scrubbing - A more advanced form of regenerative alkali scrubbing is the double or dual alkali method, which uses a clear solution of sodium salts for scrubbing, followed by precipitation of calcium sulfate with lime and limestone to

recover the reactant and produce a sludge with a low moisture content. This method reduces scrubber scaling and plugging problems. However, the sodium salts in the waste product could cause water pollution problems. Sodium salts are costly, and the loss of this reactant in the waste makes the process more expensive than lime/limestone scrubbing. The dual alkali method has been used successfully for industrial boilers but is not yet in service in this country at a coal-fired generating plant greater than 20 MW.

Recovery or Regenerative Processes. These processes produce small amounts of waste, recycle the material used as a reactant, and yield a potentially marketable by-product such as elemental sulfur, sulfuric acid, or gypsum. Recovery processes are presently more expensive on a first-cost and operating-cost basis than throwaway processes and may involve problems in the marketing of the by-product due to large quantities produced. If their cost can be defrayed by assumed sales revenues, they then may prove to be less expensive over the operating life of a plant.

Presently available recovery processes include magnesium oxide scrubbing, catalytic oxidation, and sodium scrubbing with thermal regeneration.

1. Magnesium Oxide Scrubbing - In the magnesium oxide scrubbing technique, one of three scrubbing solutions may be used: a clear liquor, a magnesium oxide slurry, or a magnesium oxide/magnesium dioxide slurry. The combined magnesium sulfate/magnesium sulfite intermediate product is dried and treated to recycle the magnesium and product SO_2, which can be treated to yield sulfuric acid or another sulfur by-product. Erosion, dust emissions, and other problems have been encountered. The process is presently undergoing testing and modification in large-scale demonstration plants. The treatment required to separate the intermediate product makes this process more expensive than lime/limestone scrubbing. Magnesium oxide scrubbing is considered suitable for urban areas with limited sludge disposal space and a potential market for the sulfur by-product.

2. Catalytic Oxidation - This may be done by a wet process or a dry process; the dry process can be performed at either high or low temperatures. Fly ash is removed from the flue gas before the oxidation process, in which a catalyst such as vanadium pentoxide is used to oxidize SO_2 to SO_3. The SO_3 in the flue gas combines with the water in the flue gas to form sulfuric acid. The catalyst is then cleaned and recycled. Problems have included difficulty in producing the high temperatures for the dry process and corrosion and cooler plugging in the acid section of the system. Contamination by fly ash may adversely affect the life of the catalyst. The capital cost of the system is higher than that of lime/limestone scrubbing, and there are additional marketing problems associated with the weak sulfuric acid by-product. This acid has a concentration of only 78

percent, compared to a 98 percent concentration in the acid produced by the other recovery processes. The catalytic oxidation process is at the demonstration plant stage.

3. Sodium Scrubbing - This process uses a sodium sulfite solution to absorb the SO_2. The intermediate product, sodium bisulfite, is thermally decomposed in an evaporation crystallizer unit. The sodium sulfite is recovered for reuse; the SO_2 released can then be converted into a sulfur by-product. The process is presently undergoing full-scale testing at several coal-fired facilities. Lifetime operating and labor costs are higher for sodium scrubbing than for lime/limestone scrubbing.

Other flue gas desulfurization systems, and advanced combustion processes such as fluidized bed combustion, are not viable alternatives for the proposed project because they require further research and development.

Particulate Control Alternatives

There are four major methods for particulate control:

1. Wet Scrubber - Venturi type
2. Fabric Filter (Bag House)
3. Mechanical Separators (Cyclone)
4. Electrostatic Precipitators

Wet Scrubber - Venturi Type

This system is a wet scrubber using water to remove the particulate matter. The disadvantages of using wet scrubbers for particulate removal are excessive energy consumption, the large volumes of water required, severe erosion problems, and the removal of the waste sludge.

Fabric Filter (Bag House)

The flue gases are passed through a fabric medium which collects the particulate matter. Periodically, the fabric becomes plugged and must be cleaned. Disadvantages of fabric filters are large space requirements, limited design temperatures, and higher maintenance costs. These high maintenance costs are caused by filter (bag) replacement.

Mechanical Separators (Cyclone)

Dust-laden gas enters tangentially in the upper body. The air is rotated inside the cyclone, and the cleaner air passes out at the center of the whirl. The disadvantage of cyclone separators is their low operating efficiencies. In order to meet particulate emissions limitations, cyclone separators would have to be used in conjuction with one of the aforementioned processes, thereby adding their particular disadvantages to the overall system.

Electrostatic Precipitators

With electrostatic precipitators, removal of the particulate matter suspended in the flue gas is achieved by electrostatic charging and subsequent precipitation of the particles onto a collector plate in a strong electric field. Electrostatic precipitators remove up to 99.6 percent of the particulates in the flue gas. They are highly reliable and have low operating and maintenance costs.

Nitrogen Oxide Control Alternatives

Control measures for reducing nitrogen oxide (NO_x) emissions from a boiler differ only in combustion technique. Each method can be designed to satisfy regulatory requirements. The three basic methods are:

1. Water or steam injection
2. Flue gas recirculation
3. Over-fire air, also known as two-stage combustion

The applicability of these methods may vary among different boiler manufacturers. The boiler manufacturer selected for the plant will implement one or more of the above methods for controlling NO_x.

Water Injection

In the water injection method, water is atomized at the burner and injected into the furnace along with the fuel. To reduce NO_x production, the flame temperature is lowered by drawing off some of the sensible heat liberated by the burning fuel. While NO_x reduction can be as great with this method as with others, the high loss in thermal efficiency makes this method expensive, given current fuel costs and energy resource scarcity.

Flue Gas Recirculation

Flue gas recirculation lowers the flame temperature by reducing the overall sensible heat of the flue gas through dilution. This method is easily adapted to coal firing and also produces the lowest NO_x levels of the three control methods. It is easier to control than over-fire air because only one set of dampers and fans is operating; however, capital cost is much higher.

Over-Fire Air

The over-fire air method lowers the flame temperature by burning the fuel in two stages so that all the heat is not liberated at once. In the first stage, the fuel is burned in less than stoichiometric air in the burner zone. In the second stage, the remaining stoichiometric air is introduced over the burner zone so that the rest of the fuel is consumed. This method, like gas recirculation, has been used extensively in the past to control steam temperature. The NO_x is reduced with relatively little capital cost (no expensive gas recirculation fans or ductwork are required).

3.4.3 Alternative Plant Water and Wastewater Management Systems

Plant Water Uses and Wastewater Discharges

The following table describes the water requirements of the proposed Trimble County Generating Plant.

Use	Description
Circulating Water	Removes waste heat and constitutes the single biggest water requirement
Plant Process Water	
Condensate Make-Up	Required to make up steam cycle losses and boiler blowdown. Water is of very high purity
Flue Gas Desulfurization System	Required for SO_2 removal. Water is lost from this system through evaporation and removal with SO_2 solids as sludge
Ash Handling	Required for operation of the bottom ash handling system
Miscellaneous	Water used in cleaning or for other special intermittent requirements
Domestic and Construction Water	Required for drinking purposes, sanitary facilities, the concrete batching plant, fire protection, and dust supression. A low-level use

The available sources of water for plant use are the Ohio River and ground water obtained from wells.

The following is a list of the different wastewater discharges that will result from operation of the proposed plant.

1. Circulating water discharge

2. Ash handling system discharge

3. Flue gas desulfurization system discharges

4. Solid waste processing system discharges

5. Solid waste disposal area runoff

6. Plant washdown and floor drains

7. Site rain runoff

8. Domestic wastewater discharge

The available discharge options are to the Ohio River, to land surface for ground absorption, disposal ponds, and continuous reuse of all wastewater.

The original criteria established for the water and wastewater management system are as follows:

1. Minimum discharge of wastewater to the environment

2. Maximum reuse of water (this means that one plant system's wastewater discharge may be used as another system's water source)

3. Minimum water treatment requirements (this means minimizing the amount of chemical and mechanical treatment of water before use, re-use, or discharge)

4. Satisfaction of regulatory requirements

Early in the study of water and wastewater management systems, it was decided that no water that contacts plant processes would be discharged to the environment. Also, the only discharges from the plant would be cold-side blowdown from the cooling towers, and the solid waste disposal area and site rain runoff. These decisions eliminated a large number of alternatives involving treatment and discharge of wastewater from process contacts.

The following subsections describe the alternative water sources and discharge options previously mentioned.

Alternative Water Sources

The following is a list of the water source alternatives considered for the proposed plant.

1. Deep Wells - This alternative calls for pumping of ground water from deep strata. It has the advantage that water from this source is usually of better quality than river water and requires less pre-treatment before process use. However, the plant water requirements, even in the maximum water reuse case, are too great for this type source to supply

2. Radial Wells - This approach uses a large central collection well with pipes extending horizontally into the ground and

radiating out from the well at different depths. This type of well can extract greater water quantities from the ground water because it taps the source at many levels. The water does not have as high a quality as deep wells, but it is still better than river water. However, this source has major disadvantages. First, the initial cost is extremely high. Second, the water in the quantities required for the proposed plant is uncertain for the life of the plant due to plugging of the radial wells with gravel and sand in close packing in subsoils of the type found at the Trimble County site

3. River Water - This approach requires the use of screened intakes to keep river debris and aquatic life from the water pumps. The advantages of this approach are that the water quantity required for the plant can be met and the method of meeting it is identical to that used by larger installations when a once-through use was possible. The disadvantage is the impingement/entrainment of aquatic life by intake structures

Wastewater Discharge Alternatives

The water and wastewater management plan for the proposed plant was designed to eliminate process wastewater discharge. The only discharges from the proposed plant will be non-contaminated cold-side cooling tower blowdown and possibly contaminated site stormwater runoff.

Non-contaminated cold-side cooling tower blowdown can vary from zero to an approximate maximum of 40,900 gpm with the plan. The discharge quantity range of this blowdown was selected on the basis of proven cooling tower experience with suspended solids and total dissolved solids concentrations on the order of those expected with this plan.

There are three methods of discharge for the blowdown: (1) discharge to an onsite disposal pond (see Section 3.4.5) for either reuse or later discharge to the river; (2) discharge to a land surface for ground absorption; and (3) discharge to the Ohio River. Discharge to an onsite pond is not possible, however, because the amount of blowdown is such that it would quickly overflow any pond feasibly sized for the plant site. Likewise, discharge to a land surface is not feasible because of the quantity of land involved.

The site stormwater runoff plan uses the site's natural contours to direct the rainwater to a retention basin. The release of this water to the river from the basin will be controlled and monitored. If concentrations of contaminants exceed acceptable levels for discharge, the pond contents will be chemically treated before release. The only alternative to this approach would be routing the rainwater from the retention basin to an onsite disposal pond. This, however, introduces the requirement for a pond area larger than the available plant site area.

3.4.4 Alternative Intake and Discharge Structures

Intake Structure

Selection of an intake structure must include consideration of the economics and efficiencies of plant construction and operation and the effect of the structure on the environment. Design is influenced by the requirements of the U.S. Environmental Protection Agency (EPA) and the Corps of Engineers. The EPA requires the use of the best technology available and suggests an intake water approach velocity of not more than 0.5 feet per second for fish protection. The Corps of Engineers does not have specific standards but maintains a minimum water depth of 9 feet for navigational purposes in this sector of the Ohio River. Site and Ohio River conditions applicable to the alternative intake structure evaluation are contained in Technical Appendix II.

The following criteria were used in selecting the intake structure alternatives:

1. The intake structure should be located a sufficient distance from the discharge structure to avoid recirculating the discharge water
2. The structure should be located at or above the natural river bottom to reduce silt deposition in the intake and to minimize or eliminate the need for dredging
3. The intake should be remote and protected from river traffic and not interfere with navigation
4. Intake canals should be avoided, if possible
5. Intake water approach velocity should not exceed 0.5 feet per second at normal pool elevation (420 feet Ohio River datum)
6. Trash racks should have 4-inch openings and be oriented parallel with the river current to take advantage of the natural washing effect of the river
7. Debris should be collected at the trash rack and disposed of in a satisfactory landfill or other area. Screen washings may be returned to the river
8. A safe exit for fish should be provided before or in conjunction with the traveling screens
9. Traveling screens should have 3/8-inch openings
10. Pump chamber design should provide for a uniform and continuous flow of water to the pumps without vortices

11. Stop logs or gates should be provided to isolate pump and traveling screen areas for maintenance purposes

12. Pumps should be long-shaft, vertical pumps with motors above design high water level

13. The selection of the number of pumps and their characteristics should include analysis of variable flow requirements, flow reliability, seasonal river levels, and system friction and minor losses

Makeup water from the Ohio River can best be provided by placing the intake structure in an offshore location. A conventional structure at the shoreline would require a deep excavation to provide for low velocity flow through the trash racks. This excavation would tend to silt in and would require frequent dredging. An approach canal to an onshore intake would be costly because of the depth of cut required; it could also result in entrapping and destroying fish.

The intake structure should be located a sufficient distance from the discharge structure to avoid recirculation of the effluent and impingement of the increased aquatic life attracted by the warmer water in the vicinity of the discharge. It is advantageous to locate the structure between the barge staging area and the shore for protection from the river traffic and floating debris (Figure 3.4.4-1).

Offshore intakes may be of conventional design (log booms, trash racks, and screens) or may be of perforated pipe or filter bed design. An intake that filters water through a pervious river bottom or through a man-made filter created by placing granular material over the bottom is subject to clogging and is difficult to maintain. The cost of a filter bed collection system is higher than a comparable conventional intake, and, to date, no large-scale system has been developed and proven reliable in operation. Radial well intakes, however, have proven to be dependable where suitable water-bearing permeable materials are located.

A conventional intake and a perforated pipe intake above the river bottom offer the most advantages and are discussed below.

Conventional Intake Structure Design

A conventional intake structure (Figure 3.4.4-2) may have to be protected from large floating debris with a boom, floating curtain, or other device. The debris problem is expected to be minor because the site is on the inside bend of the river; most floating material is carried to the far side. The barge unloading facilities and operations will also protect the area from floating material. Trash racks at the face of the structure will prevent medium-sized material from entering the structure. Placing the racks parallel with the river current and the bars at an angle downstream (as shown in Figure 3.4.4-2) will reduce the amount of material retained on the racks.

Smaller debris and fish passing through the trash racks are prevented from entering the plant by traveling screens. Fish should not be impinged on the screens and destroyed by lack of oxygen, by the high pressure spray used to clean the screen, or by the debris disposal system. The vertical traveling screen shown in Figure 3.4.4-3 provides satisfactory screening for sizeable river fluctuations and has an excellent maintenance history. Vertical slots in the walls of the screenwells allow fish to swim out of the structure. There is a horizontal traveling screen on the market now which safely bypasses fish; however, it presently is restricted to a maximum height of 15 feet and, therefore, is not applicable to the proposed facility.

If necessary, vertical traveling screens can be adapted for bypassing fish by operating the traveling screens continuously and using modified screen baskets and low-velocity jets that direct fish to a separate return trough (see Figure 3.4.4-4). Operating the screens continuously serves to reduce the time of fish impingement and to increase the fish survival rate. Fish protection may also be provided by installing the traveling screens at an angle to the direction of flow or placing a louvered grid in the approach bay to direct fish to a satisfactory outlet. Other behavioral screening systems such as air bubble currents, electric fields, and light and sound barriers have had only limited success.

Perforated Pipe Intake Structure Design

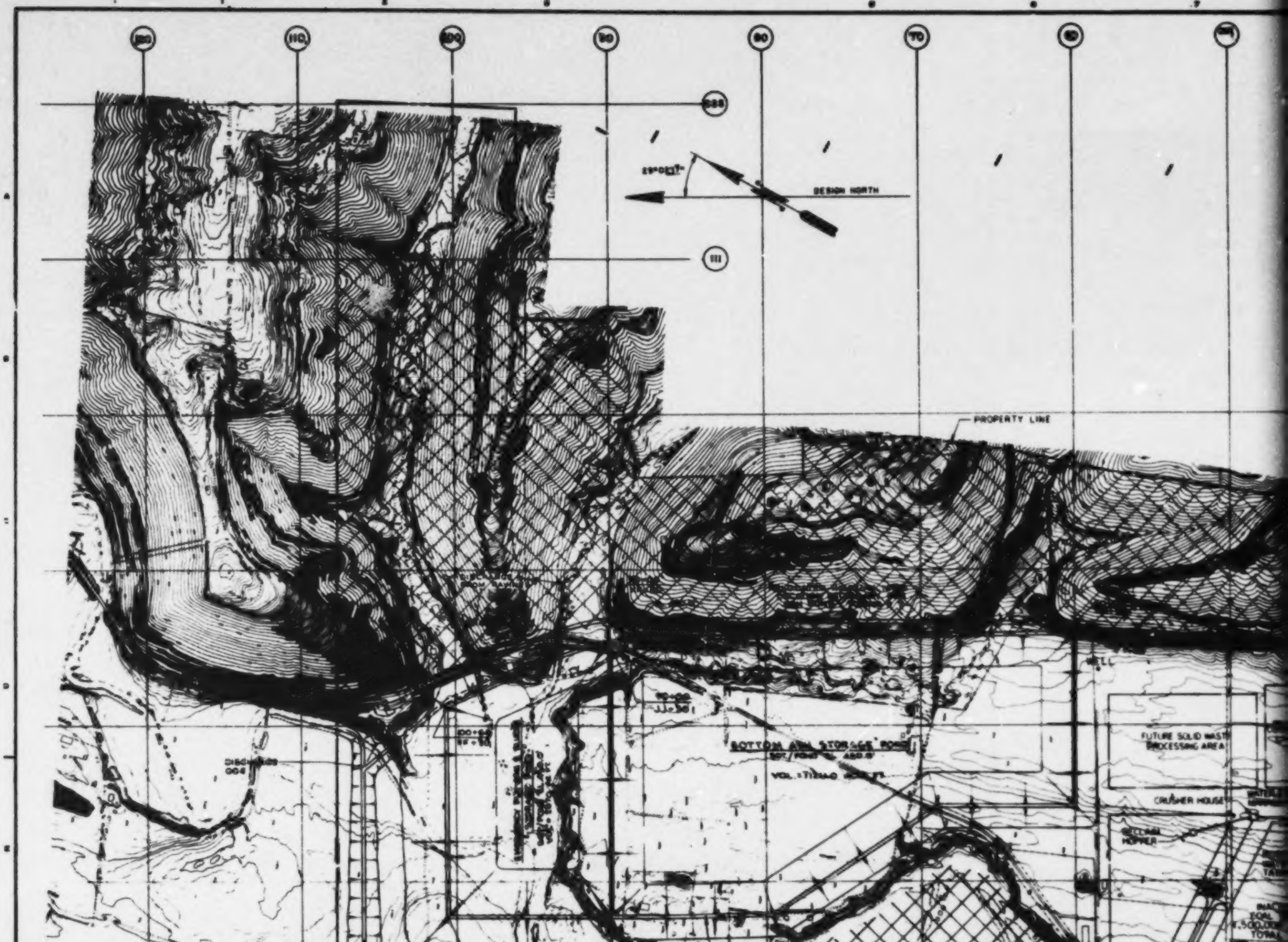
The perforated pipe system illustrated in Figure 3.4.4-5 does not require trash racks, traveling screens, debris removal, fish protection, or provisions for deicing and has been found to cost less to construct and operate than conventional intake structures. Intake velocities through the holes are under 0.5 feet per second at maximum flow; 1/2- to 1-inch from the pipe, intake velocities are much less. Model tests show that the inner sleeve causes a restriction of flow that results in a uniform velocity distribution along the outer pipe. As a result, fish tend to follow the river flow and are not impinged on the pipes.

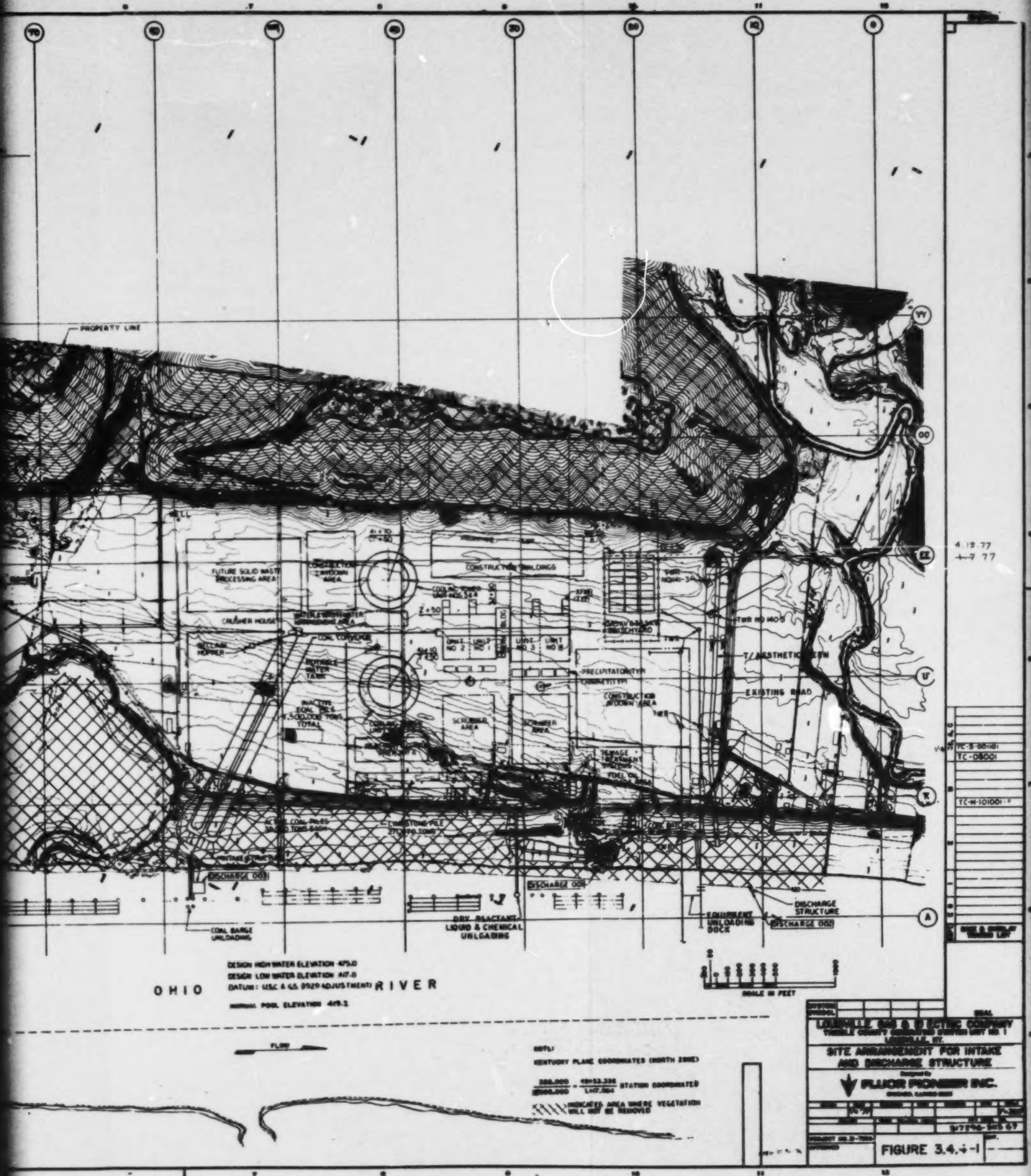
The perforated units are placed above the river bottom so that sand and silt being transported along the bottom are not drawn into the pipe. Protection from large floating debris and water craft is required, and warning lights or other devices should indicate the pipe locations. The perforated pipe system has no moving parts, and the only maintenance expected is occasional backwashing. Provision is made, however, for unfastening and removing the units if necessary.

Siting Considerations

The location of either the conventional intake or the perforated pipe intake along the shoreline affects the length of the pump discharge piping required, the water depth in the area, access for operation and maintenance, and the potential for siltation; it also provides protection of the intake structure from debris and river traffic. The area between the shoreline and the mooring cells provides an area having no barge traffic; this area is also protected from large, floating debris.

Because the length of the makeup piping from the structure to the cooling towers should be as short as possible, a location


120
110
100
90
80
70
60
111
DESIGN NORTH
PROPERTY LINE
BOTTOM ASH STORAGE POND
FUTURE SOLID WASTE PROCESSING AREA
CRUSHER HOUSE
HOPPER
WELL
DISCHARGE 004
DISCHARGE 001
INTAKE STRUCTURE
COAL BARGE UNLOADING
OHIO
DESIGN HIGH WATER ELEV
DESIGN LOW WATER ELEV
DATUM : U.S.C. & G.S.
NORMAL POOL ELEVATION
SAILING LINE
FLOW

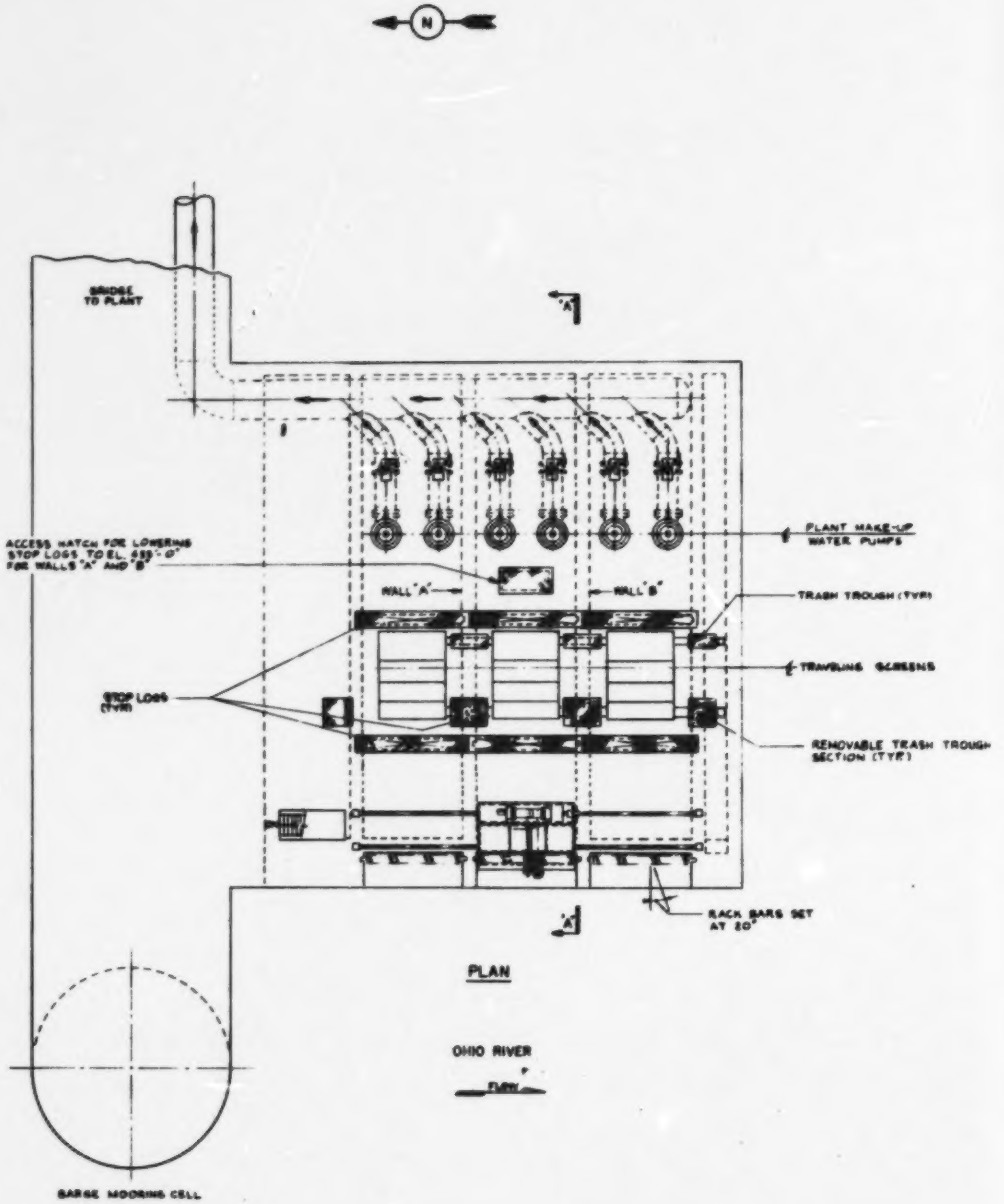

PROPERTY LINE
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION LAYDOWN AREA
CRUSHER HOUSE
WATER & WASTEWATER LAYDOWN AREA
COAL CONVEYOR
RECLAIM HOPPER
ROTARY WATER TANK
INACTIVE COAL PILE 1,500,000 TONS TOTAL
COOLING TOWER UNIT NO.3 & 4
COOLING TOWER
Z+50
CONSTRUCTION BUILDINGS
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO 4
BLDG
PRECIPITATOR (TYP)
CHIMNEY (TYP)
SCRUBBER AREA
CONSTRUCTION LAYDOWN AREA
SEWAGE TREATMENT STATION
FUEL OIL STORAGE AREA
T/AESTHETIC BERM
EXISTING ROAD
ACTIVE COAL PILES
LIMESTONE PILE
COAL BATCHING
INTAKE STRUCTURE
DISCHARGE 001
DISCHARGE 002
DISCHARGE 003
DISCHARGE STRUCTURE
COAL BARGE UNLOADING
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
OHIO RIVER
DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS 1929 ADJUSTMENT
NORMAL POOL ELEVATION 419.3
FLOW
NOTE:
KENTUCKY PLANE COORDINATES (NORTH ZONE)
INDICATES AREA WHERE VEGETATION WILL NOT BE REMOVED
SCALE IN FEET
STATION COORDINATES
YY
OO
EE
U
T
A
4.12.77
TC-S-00101
TC-08001
TC-M-101001
917296-SK5 67

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.

SITE ARRANGEMENT FOR INTAKE AND DISCHARGE STRUCTURE

Designed by
FLUOR PIONEER INC.

FIGURE 3.4.4-1



N
BRIDGE TO PLANT
'A'
PLANT MAKE-UP WATER PUMPS
ACCESS HATCH FOR LOWERING STOP LOGS TO EL. 455'-0" FOR WALLS 'A' AND 'B'
WALL 'A'
WALL 'B'
TRASH TROUGH (TYP)
TRAVELING SCREENS
STOP LOGS (TYP)
REMOVABLE TRASH TROUGH SECTION (TYP)
RACK BARS SET AT 20°
'A'
OHIO RIVER
FLOW
BARGE MOORING CELL

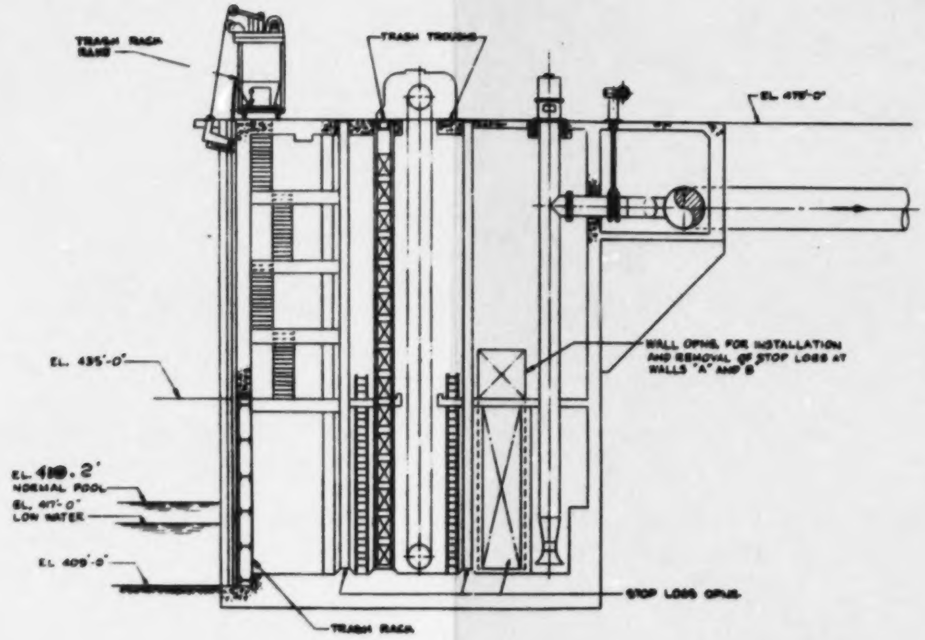
PLAN

MAKE-UP
PUMPS

TROUGH (TYP)

SCREENS

LE TRASH TROUGH
(TYP)


TRASH RACK RAKE
TRASH TROUGH
EL. 475'-0"
WALL OPNG. FOR INSTALLATION AND REMOVAL OF STOP LOGS AT WALLS 'A' AND 'B'
EL. 435'-0"
EL. 418.2'
NORMAL POOL
EL. 417'-0"
LOW WATER
EL 409'-0"
STOP LOGS OPNG.
TRASH RACK

SECTION 'A-A'

REMOVED BLDG. OVER STRUCTURE.
6-14-76

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE

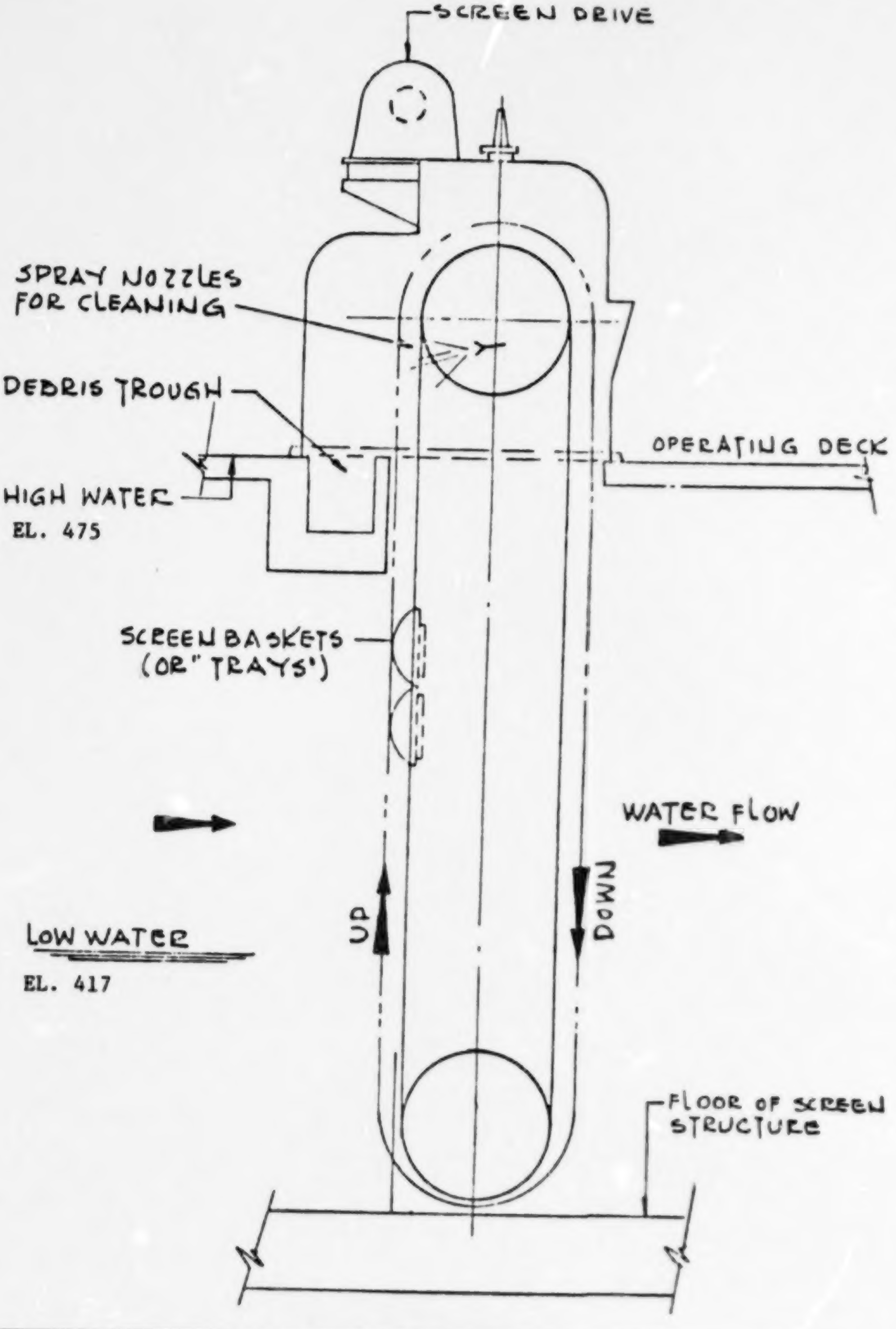
RECOMMENDED CONVENTIONAL INTAKE STRUCTURE

FLUOR PIONEER INC.

317206-200440

FIGURE 3.4.4-2

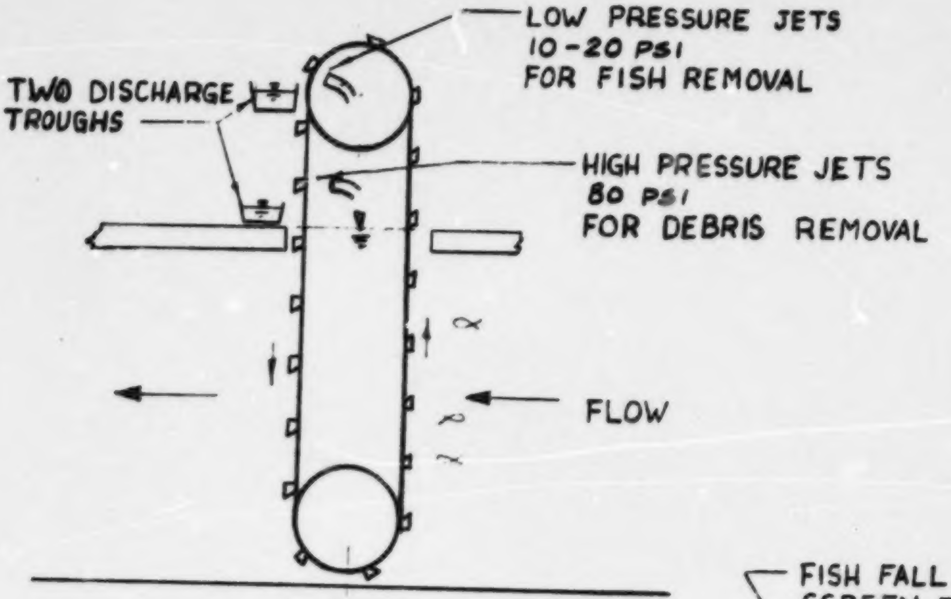
A


SCREEN DRIVE
SPRAY NOZZLES FOR CLEANING
DEBRIS TROUGH
OPERATING DECK
HIGH WATER
EL. 475
SCREEN BASKETS (OR "TRAYS')
WATER FLOW
UP
DOWN
LOW WATER
EL. 417
FLOOR OF SCREEN STRUCTURE

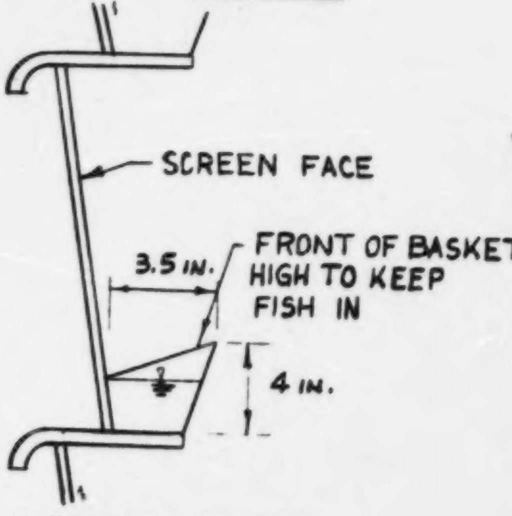
FLUOR PIONEER INC.

December 2, 1975	LOUISVILLE GAS & ELECTRIC COMPANY TRIMBLE COUNTY PLANT SITE CONVENTIONAL VERTICAL TRAVELING SCREEN	Figure 3.4.4-3
Project 317296		

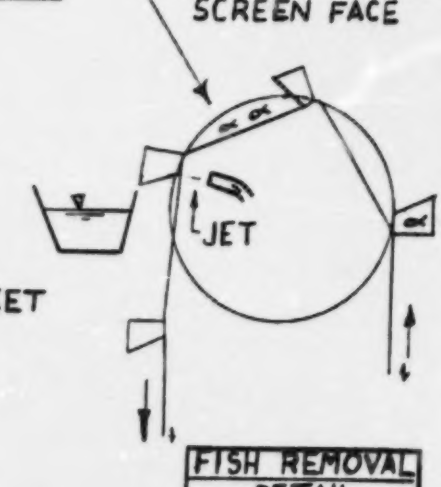
FORM C-311 11/13/74


LOW PRESSURE JETS
10-20 PSI
FOR FISH REMOVAL
TWO DISCHARGE
TROUGHS
HIGH PRESSURE JETS
80 PSI
FOR DEBRIS REMOVAL
FLOW

SECTION


SCREEN FACE
3.5 IN.
FRONT OF BASKET
HIGH TO KEEP
FISH IN
4 IN.

BASKET DETAIL


FISH FALL OFF TO
SCREEN FACE
JET

FISH REMOVAL
DETAIL

FLUOR PIONEER INC.

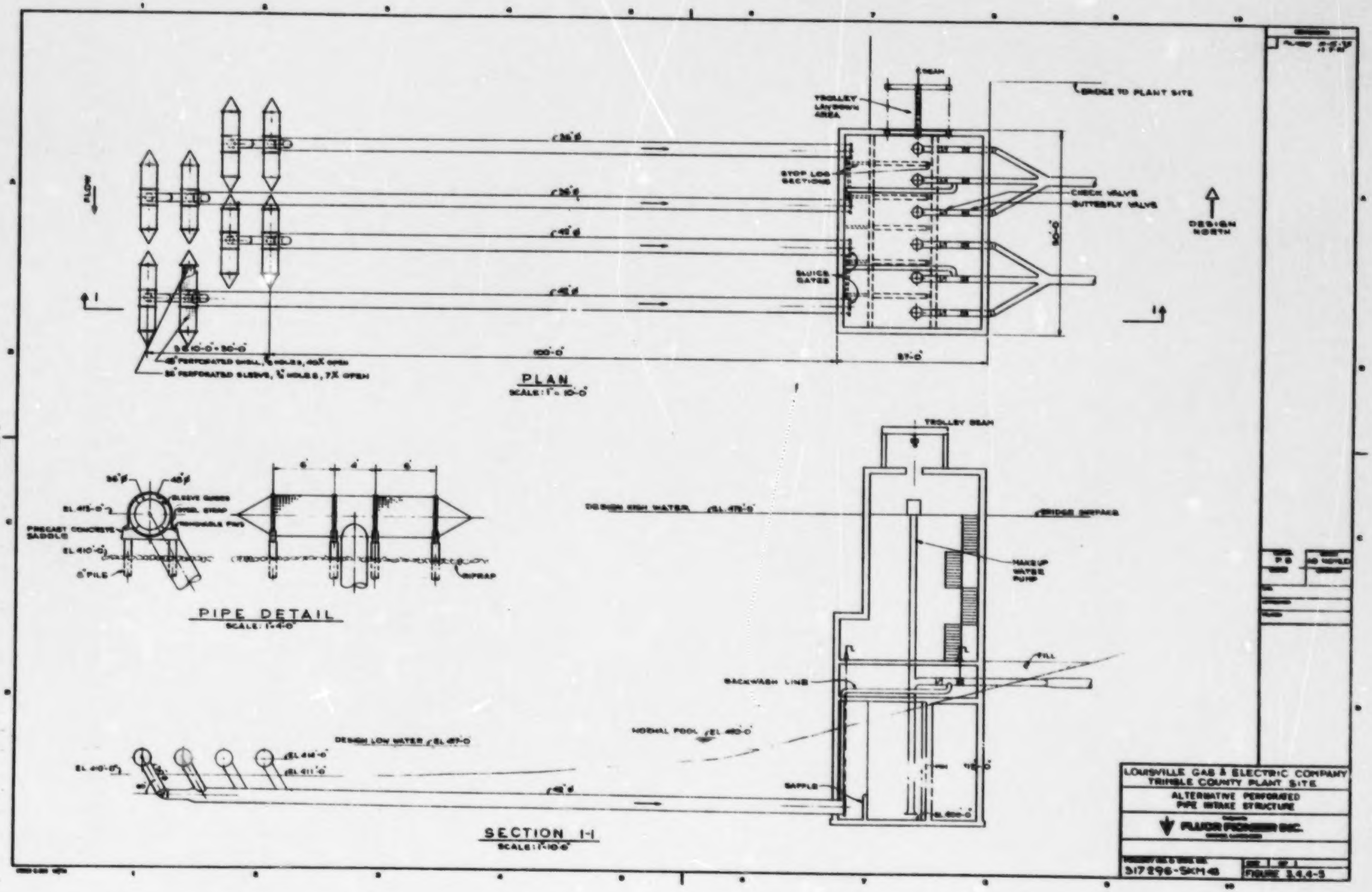
December 2, 1975

Project 317296

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE
MODIFIED VERTICAL TRAVELING SCREEN

FIGURE
3.4.4-4

FORM C 311 11/13/74


FLOW
1
c 36" ϕ
c 36" ϕ
c 42" ϕ
c 42" ϕ
3 @ 10'-0" = 30'-0"
48" PERFORATED SHELL, ⅝" HOLES, 40% OPEN
36" PERFORATED SLEEVE, ⅝" HOLES, 7% OPEN
100'-0"
PLAN
SCALE: 1" = 10'-0"
TROLLEY LAYDOWN AREA
℄ BEAM
STOP LOG SECTIONS
SLUICE GATES
BRIDGE TO PLANT SITE
CHECK VALVE
BUTTERFLY VALVE
50'-0"
37'-0"
DESIGN NORTH
1
TROLLEY BEAM
DESIGN HIGH WATER ⊊EL 475'-0"
⊊BRIDGE SURFACE
MAKEUP WATER PUMP
FILL
BACKWASH LINE
NORMAL POOL ⊊EL 420'-0"
BAFFLE
EL 400'-0"
DESIGN LOW WATER ⊊EL 417'-0"
EL 414'-0"
EL 411'-0"
EL 410'-0"
c 42" ϕ
SECTION 1-1
SCALE: 1" = 10'-0"
36" ϕ
48" ϕ
SLEEVE GUIDES
STEEL STRAP
REMOVABLE PINS
EL 415'-0"
PRECAST CONCRETE SADDLE
EL 410'-0"
8" PILE
6'
4'
6'
RIPRAP
PIPE DETAIL
SCALE: 1" = 4'-0"

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE

ALTERNATIVE PERFORATED
PIPE INTAKE STRUCTURE

FLUOR PIONEER INC.

317296-SKM48

FIGURE 3.4.4-5

immediately downslope of the cooling tower for Units 1 and 2 would be most economical. The river bottom is at elevation 409 in this area; however, placing the structure near the coal unloading facility would provide an additional 2 feet of depth.

Construction of the cells and the unloading facilities will tend to reduce river velocities in this area and could result in increased siltation around the intake structure.

The amount of induced siltation should be considered in determining the elevation of the structure, in providing means of minimizing siltation at the intake, or in determining the extent of dredging that will be necessary. Raising the elevation of the intake would require either a wider conventional structure to maintain low approach velocities, or a larger system of smaller pipes in a perforated pipe system.

Placing the conventional intake apart from the mooring cells would tend to maintain flow across the face of the structure and help clear fish and debris and reduce siltation across the face of the trash racks. A location close to the mooring cells would have the added advantage of making the structure less noticeable and more aesthetically acceptable.

The depth at design low water level is barely adequate for the perforated pipe intake system, and a large amount of siltation could cause heavy silt intake and clogging of the system. Regular backflushing with water or air and dredging of the area could be required. Moving the intake upstream to an area subject to little or no siltation would increase the cost of the conveyance system and the possibility of damage from river traffic.

Loss of normal river water levels because of a barge accident or gate or lock malfunction at McAlpine Dam in Louisville is extremely unlikely, but if this occurred, it would not be possible to draw water in through either structure.

Placing an inlet to the conventional intake structure or the perforated pipe near the river bottom at mid-channel would provide makeup water at the lowest possible levels and would also diminish or eliminate the potential for siltation at normal levels. The longer intake pipes and deeper pump structure would increase the cost of construction and difficulty of inspection and maintenance and would require the approval of the Corps of Engineers.

A bridge to the conventional intake structure is required for service personnel and debris removal and could be used for support of the pump discharge piping. The perforated pipe system would require a shorter bridge because the pump structure would be located onshore. The location of either structure adjacent to the coal or limestone unloading facility would allow dual use of a bridge. There is a remote possibility, however, that a coal or limestone spill could result in clogging the intake or contaminating the makeup water.

Closing a portion of either intake system for maintenance would temporarily increase intake velocities. Maintenance can normally be scheduled when the plant is not operating at full load, however, so that velocities do not exceed acceptable limits.

Discharge Structure

The design of the discharge structure must consider the economics of transporting cooling tower blowdown from the plant and dispersing it in the Ohio River in a suitable fashion, consistent with efficient plant operations and protection of the environment. Design is controlled by regulations of the EPA, the Commonwealth of Kentucky, and the Corps of Engineers. Requirements for discharges from fossil-fuel and nuclear plants are the same.

U.S. Environmental Protection Agency regulations allow the discharge of blowdown from the cold side of the circulating water system without treatment, as long as effluent meets water quality standards. If it does not, treatment of blowdown may be required.

Kentucky has regulations for the protection of the river fish population. The regulations for aquatic life protection specify that the area immediately adjacent to an outfall shall be "as small as possible, be provided for mixing only, and shall not prevent the free passage of fish and drift organisms."

The Corps of Engineers must issue a permit for any construction within the Ohio River (measured at Ordinary High Water at the site, elevation 428.5 USC and GS datum).

The following criteria were used in selecting the discharge structure alternatives:

1. The discharge structure should be designed for velocities of 8 to 10 feet per second for normal operation. Maximum expected flows should have velocities no higher than 20 feet per second, and minimum expected flows should have velocities no lower than 2 feet per second
2. The length of the structure and open channel at the outfall should be as short as feasible
3. Branch lines connecting with the main discharge structure should enter at a 45° angle or less for a smooth transition of flow
4. For economy, underground installation should have only that minimum cover necessary for protection from freezing and superimposed surface loadings
5. Manhole access should be provided (a) at every change in direction or junction or every 500 feet along the structure, (b) at

each end of an inverted siphon, if any, and (c) at the outfall at a point above normal pool level

6. Discharge velocity should be equal to or greater than 10 times the river current velocity
7. Discharge from an in-channel outlet should be designed and located at a sufficient depth and distance offshore to provide dilution water access around the entire circumference of the plume. The point of discharge should be above the bottom so that benthic organisms do not receive a significant impact, and significant scouring and suspension of sediments do not occur
8. Provision should be made to minimize river bottom erosion and downstream siltation. The outfall should be protected from undercutting by erosive action and from clogging with sediment and debris
9. The discharge should be designed to promote rapid mixing and dispersal of the effluent to reduce temperatures and chemical concentrations and to avoid recirculation through the intake structure
10. The location of the outlet should be in an area of low average biomass, productivity, and occurrence of critical life stages to avoid or reduce plume entrainment damage

The design of the discharge structure requires an analysis and evaluation of a number of considerations which may be categorized under: (1) the methods of discharge, (2) the characteristics of the physical structure, and (3) the external effects of the discharge. Methods of discharge are discussed in Section 3.4.3. The latter two considerations are discussed in the following paragraphs.

Discharge Structure Characteristics

The characteristics of the discharge structure depend on hydraulic, structural, and external considerations. The size and gradient of the structure should be designed to provide for the economic and effective conveyance of expected blowdown flows from the cooling tower basins and suitable discharge into the receiving waters. The length of the system should normally be as short as practicable for the lowest installed cost and system head loss and the shortest time of entrainment for aquatic organisms.

Discharge structure alternatives considered for this project concerned: (1) the method of conveyance, (2) the location and design of the blowdown line, (3) the method of discharging into the river, and (4) the design of the outlet structure.

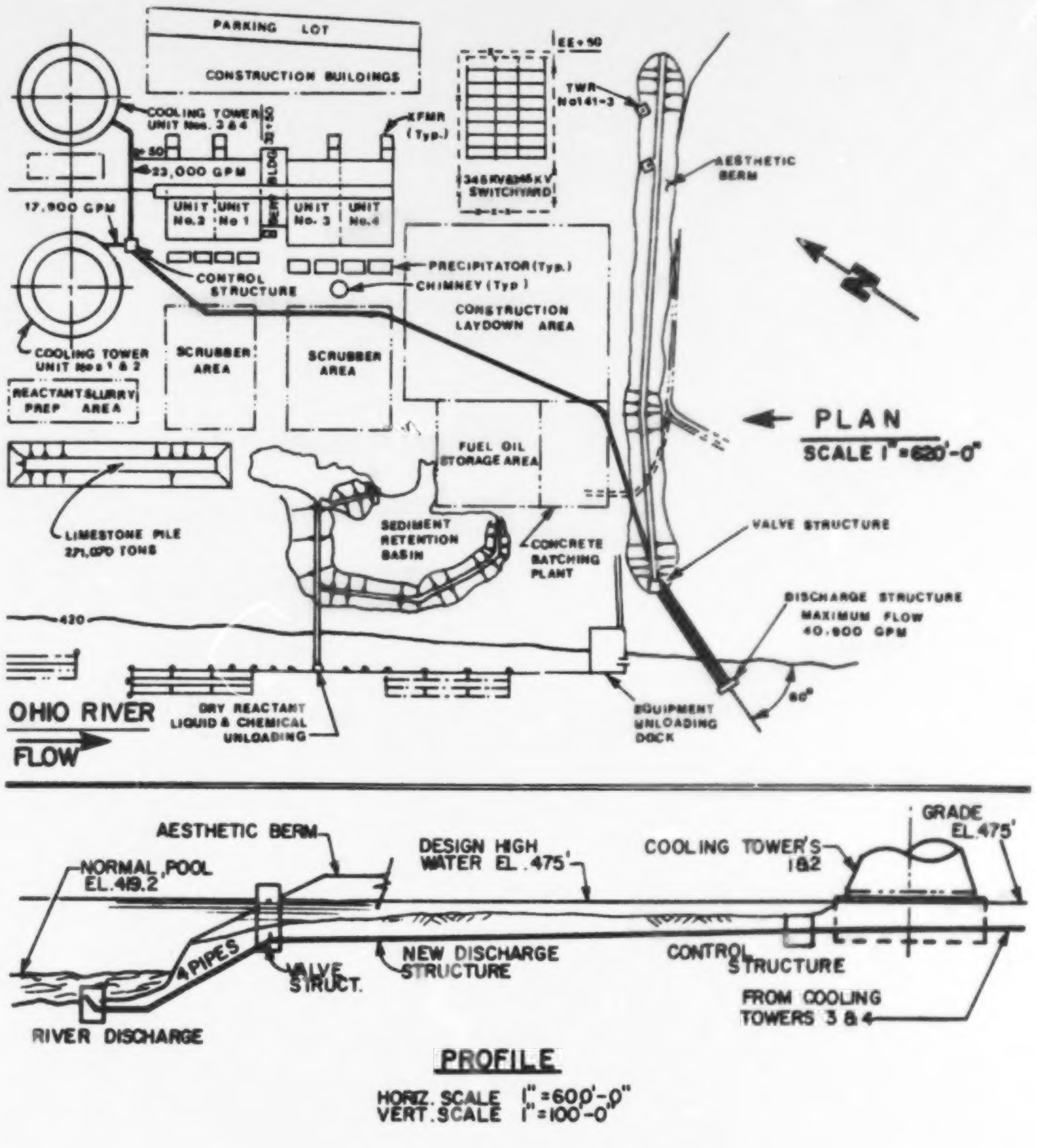
Discharge conveyance methods considered were: pumping, gravity flow, and a combination of the two. Gravity flow was chosen over pumping because of better reliability and lower operating costs. A combination of gravity flow and pumping was considered to handle large discharge volumes when the river is at high levels. During ordinary river levels, gravity flow as a method of conveyance is feasible, but at high levels discharge by gravity flow through the normally used outlet is not feasible. The use of a circulating pump to discharge extraordinarily large flows of blowdown from each cooling tower basin during high river levels was considered but rejected as an alternative. The method chosen for this contingency was gravity flow through a bypass outlet above the high water level. The bypass outlet is located at the foot of the aesthetic berm; additional emergency outlets, discharging onto inundated grounds, can be provided at the cooling tower basins.

Alternative locations for the blowdown line are shown in Figures 3.4.4-6 and 3.4.4-7. The arrangement shown in Figure 3.4.4-6 provides for a relatively long blowdown line and a single point discharge downstream from plant facilities. Figure 3.4.4-7 shows a more direct route for the discharge, with the blowdown line leading to an outlet near the dry reactant, liquid, and chemical unloading dock. This more direct route would result in less head loss through the structure and would allow gravity discharge to the river at higher flood levels than the indirect route. However, the outlet location associated with the direct route would result in less thermal dispersion because of barge operations and the proximity of the unloading facilities. Because it offers better capability for dispersion, the more indirect route with discharge outlet downstream from plant facilities was chosen.

Choices for the design of the blowdown line were a buried conduit or an open channel. A buried conduit, large enough to avoid damaging velocities at high flows, was chosen over an open channel because of lack of disturbance to surface operations, appearance, flexibility provided in carrying various flow rates, and protection afforded from external conditions.

Alternatives considered for discharging into the river were to discharge above the surface or below it. Discharge above the surface can result in occasional fogging, more extensive end treatment for energy dissipation, and less mixing and thermal dispersion of the effluent. Discharge below the surface provides for better mixing and thermal dispersion of the effluent and is less noticeable. For these reasons, discharge below the surface was chosen.

A design for a submerged discharge outlet, shown in Figure 3.4.4-8, was developed; the outlet consists of a cluster of four pipes, buried in the river bottom and leading into the river. Remotely controlled butterfly valves direct the blowdown from an onshore conduit manifold to one or more of four submerged nozzles located in the river at sufficient distance from the shoreline to permit mixing and dispersion of the discharge effluent. The nozzles are of different sizes so that it becomes possible to discharge any blowdown volume at acceptable jet velocities. The discharge jet velocities will range from 5 to 20 feet per second, depending on discharge flow. The jets form an angle of 60 degrees with the river current and are directed up from the horizontal at an inclination of 15 degrees to facilitate dispersion.


PARKING LOT
CONSTRUCTION BUILDINGS
COOLING TOWER UNIT Nos. 3 & 4
XFMR (Typ.)
EE+50
TWR No141-3
345KV&345KV SWITCHYARD
AESTHETIC BERM
23,000 GPM
17,900 GPM
UNIT No.2
UNIT No 1
UNIT No. 3
UNIT No.4
SERV. BLDG.
CONTROL STRUCTURE
PRECIPITATOR (Typ.)
CHIMNEY (Typ)
CONSTRUCTION LAYDOWN AREA
COOLING TOWER UNIT Nos 1 & 2
SCRUBBER AREA
SCRUBBER AREA
REACTANT SLURRY PREP AREA
FUEL OIL STORAGE AREA
PLAN
SCALE 1" = 620'-0"
LIMESTONE PILE 271,070 TONS
SEDIMENT RETENTION BASIN
CONCRETE BATCHING PLANT
VALVE STRUCTURE
DISCHARGE STRUCTURE MAXIMUM FLOW 40,900 GPM
420
60°
OHIO RIVER
FLOW
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
AESTHETIC BERM
NORMAL POOL EL. 419.2'
DESIGN HIGH WATER EL. 475'
COOLING TOWERS 1 & 2
GRADE EL. 475'
4 PIPES
VALVE STRUCT.
NEW DISCHARGE STRUCTURE
CONTROL STRUCTURE
FROM COOLING TOWERS 3 & 4
RIVER DISCHARGE
PROFILE
HORIZ. SCALE 1" = 600'-0"
VERT. SCALE 1" = 100'-0"

DESIGNED BY
FLUOR PIONEER INC.
CHICAGO, ILLINOIS 60606

DRAWN	DATE	DESIGNED	DATE	CHECKED	DATE	SCALE
V.A.D.	1-8-77					

REVISION

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY

RECOMMENDED ARRANGEMENT
DISCHARGE STRUCTURE

DESIGN GROUP LEADER	DATE	FILMED DATE	CLIENT DWG. NO.

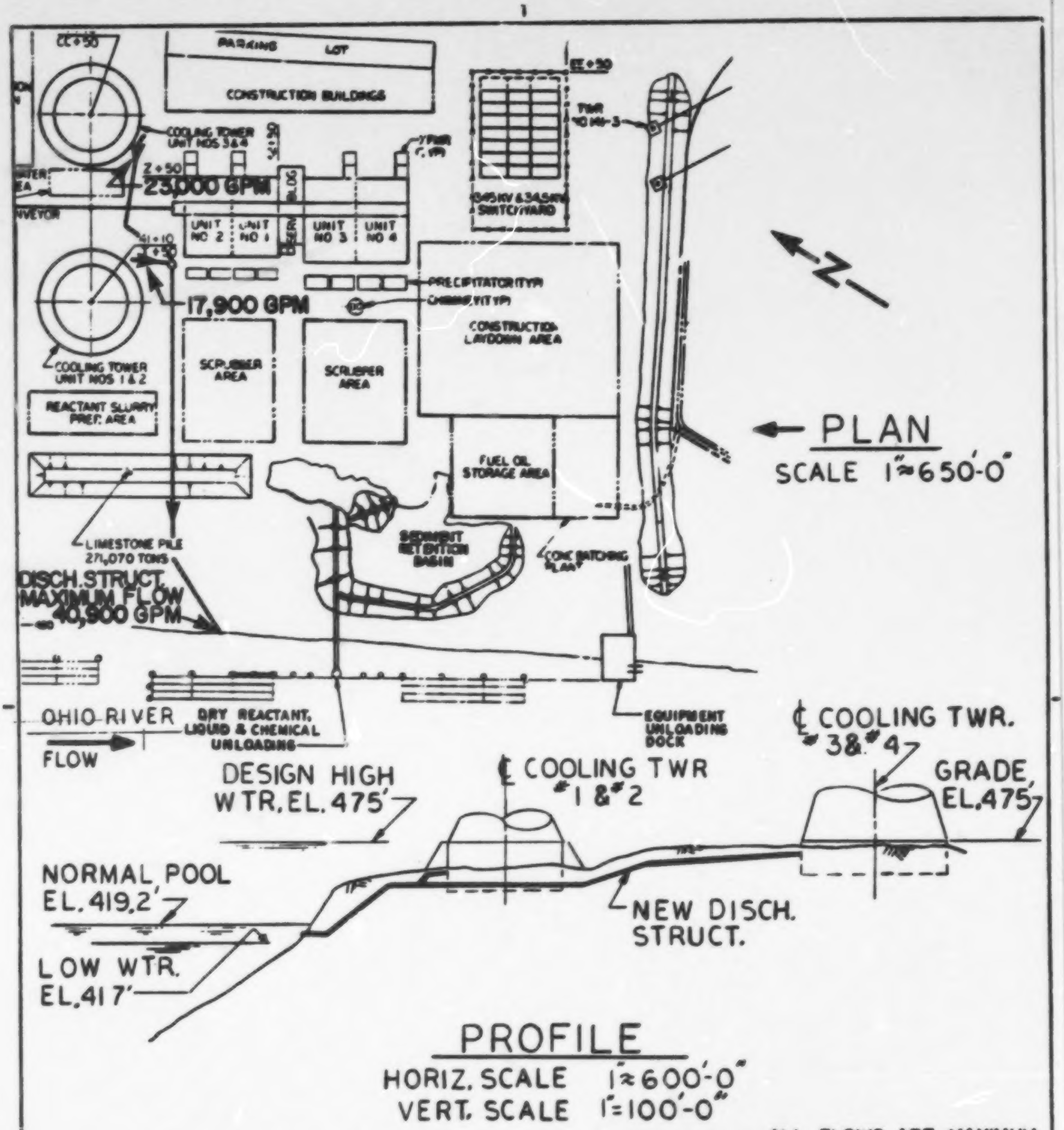
APPROVED

PROJECT NO 31-7296 SHT

DWG. NO REV.

FIGURE 3.4.4-6

1


CC+50
PARKING LOT
CONSTRUCTION BUILDINGS
EE+50
TWR
COOLING TOWER UNIT NOS 3 & 4
23,000 GPM
Z+50
CONVEYOR
BLDG
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO 4
345 KV & 345 KV SWITCHYARD
41+10
17,900 GPM
PRECIPITATOR (TYP)
CHIMNEY (TYP)
CONSTRUCTION LAYDOWN AREA
COOLING TOWER UNIT NOS 1 & 2
SCRUBBER AREA
SCRUBBER AREA
REACTANT SLURRY PREP. AREA
FUEL OIL STORAGE AREA
SEDIMENT RETENTION BASIN
LIMESTONE PILE 271,070 TONS
CONC BATCHING PLANT
DISCH. STRUCT. MAXIMUM FLOW 40,900 GPM
OHIO RIVER
FLOW
DRY REACTANT, LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
N
PLAN
SCALE 1"≈650'-0"
DESIGN HIGH WTR. EL. 475'
℄ COOLING TWR #1 & #2
℄ COOLING TWR. #3 & #4
GRADE EL. 475'
NORMAL POOL EL. 419.2'
LOW WTR. EL. 417'
NEW DISCH. STRUCT.
PROFILE
HORIZ. SCALE 1"≈600'-0"
VERT. SCALE 1"=100'-0"

ALL FLOWS ARE MAXIMUM

DESIGNED BY
FLUOR PIONEER INC.
CHICAGO, ILLINOIS 60606

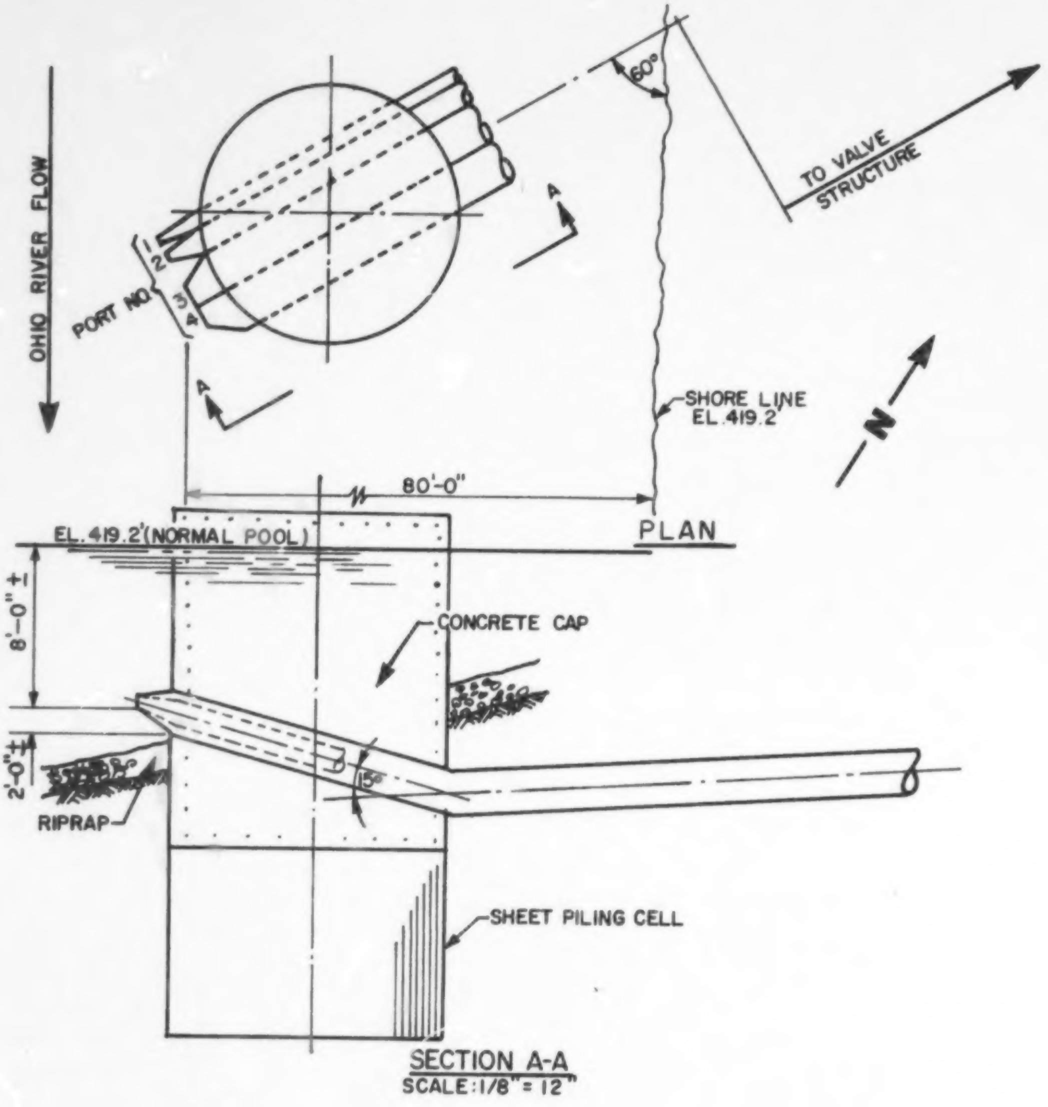
DRAWN	DATE	DESIGNED	DATE	CHECKED	DATE	SCALE
V.A.D.	1/4/77					

REVISION
4-19-77

LOUISVILLE GAS & ELECTRIC CO
TRIMBLE COUNTY
ALTERNATIVE ARRANGEMENT
WASTEWATER DISCHARGE STRUCTURE

DESIGN GROUP LEADER	DATE	FILMED DATE	CLIENT DWG. NO.

APPROVED
PROJECT NO. 31-7296
SHT.
DWG. NO
FIGURE 3.4.4.-7
REV.


60°
TO VALVE STRUCTURE
OHIO RIVER FLOW
A
PORT NO.
1
2
3
4
A
SHORE LINE
EL. 419.2'
N
80'-0"
PLAN
EL. 419.2'(NORMAL POOL)
8'-0" ±
CONCRETE CAP
2'-0" ±
15°
RIPRAP
SHEET PILING CELL
SECTION A-A
SCALE: 1/8" = 12"

DESIGNED BY
FLUOR PIONEER INC.
CHICAGO, ILLINOIS 60606

DRAWN	DATE	DESIGNED	DATE	CHECKED	DATE	SCALE
V.A.D.	11-7-77					

REVISION

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY

RECOMMENDED OUTLET STRUCTURE

DESIGN GROUP LEADER	DATE	FILMED DATE	CLIENT DWG NO

APPROVED

PROJECT NO 31-7296
SHT
DWG NO FIGURE 3.4.4-8
REV

Velocities associated with this structure with respect to residual chlorine concentrations in the plume will be sufficient to ensure compliance with all standards. A technical analysis of the proposed discharge structure is presented in Technical Appendix X.

The cluster of pipes at the river bottom will be encased in a concrete cap supported by a sheet piling cell. During construction, the sheet piling will allow dewatering and act as a form for the concrete cap, preventing undercutting. Riprap will surround the cap and protect the structure from the effects of erosion by strong currents in the river.

The submerged outlet is designed in such a manner that the plume from the blowdown water will be dispersed in the smallest area. Consequently, the effects on the river environment and aquatic life will be minimal. Floating debris will not be trapped. It is not expected that dredging around the outlet in the river bottom will become necessary.

Two designs for shoreline structures, shown in Figures 3.4.4-9 and 3.4.4-10, were proposed, but the decision to discharge below the surface of the river obviated the need for a choice between the two. The shoreline outlet, as shown in these figures, would require sheet piling cutoff walls, concrete aprons, headwalls and wingwalls, and gravel or riprap bank and river bottom protection against erosion. A tight sheet piling wall around the periphery of the shoreline outlet would allow a minimum encroachment of the channel and the least effect on the aquatic environment.

The design of the shoreline outlet structures would provide for as little projection into the channel of the river as possible so as to minimize the effect of the current; to avoid the collection of brush and debris and the entrapment of fishes; and to reduce the effect on the aquatic environment. Frequent dredging to clear the outlet channel would not be necessary with either of the proposed shoreline structures, nor would navigation be impeded.

Discharge Velocity

A high discharge velocity and resulting turbulence aid in dispersing the blowdown effluent. However, high discharge velocity can cause erosion at the outlet, bottom scouring, and downstream siltation. Low discharge velocities, on the other hand, tend to result in a stratified thermal plume and a slow rate of dispersion. The American Nuclear Society (ANS) recommends velocities at least 10 times the river velocity. At the site, normal river velocities vary from 0.5 to 2 feet per second.

The three alternative discharge structures all have discharge velocities within the ANS guidelines. However, the two shoreline structures could create the problems identified for high discharge velocity. The preferred alternative structure avoids the problems of bottom scouring and downstream siltation by directing the discharge towards the surface. This also allows for more rapid dispersion. However, at very low river velocities, the preferred structure could cause high surface velocities.

A description of the impacts associated with discharge of the cooling tower blowdown is presented in Section 6.3.3.

3.4.5 Alternative Solid Waste Disposal Schemes

Introduction

Solid wastes produced by a coal-fired generating station such as the one proposed are ash from coal combustion and a sludge-type waste from the SO_2 scrubber (see Section 3.4.2).

Ash is a nonburnable component of coal and is of two major kinds: bottom ash and fly ash. Bottom ash is larger than fly ash and will be collected at the bottom of boiler furnaces. Fly ash is a very fine material and will be collected by the electrostatic precipitators (see Section 3.4.2).

Scrubber wastes result when SO_2 is removed from boiler exhaust (flue) gases. They consist of the solids precipitated during the reaction between the limestone slurries in the scrubbers and the SO_2 in the flue gas. These solids are collected in the bottom slurry of the scrubber's clarifier or thickener.

Technical Appendix III contains the criteria, data, and assumptions used in the evaluation of solid waste disposal systems and schemes for the proposed plant. The amount of fly ash, bottom ash, and sludge generated by a plant is a function of the parameters listed there. The expected quantity of ash and scrubber sludge waste used in this report for both unit sizes over the expected life of the plant (30 years) was calculated on the basis of the parameters defined in the appendix.

The following is a brief outline of the factors determining the amount of solid wastes that will be produced by the proposed plant at any one time.

1. Sludge quantity is directly affected by the sulfur content of the coal used in the plant. Appendix F defines the design basis (Alston #1 raw coal) used to estimate sludge quantities
2. Sludge quantity is also affected by the SO_2 removal efficiency of the scrubber
3. Sludge quantity is also affected by the capacity factor/coal-use rate--that is, the amount of sludge produced by a plant is directly proportional to the number of hours the plant operates per year at a given load and coal quality
4. The ratio of sulfite to sulfate in the reactant also affects the amount of sludge

A total of 7,200 acre-feet of bottom ash will be produced during the 30-year life of the plant (240 acre-feet per year).[a] A total of 154,200 acre-feet of fly ash and scrubber sludge will be produced during the same period (5,140 acre-feet per year).

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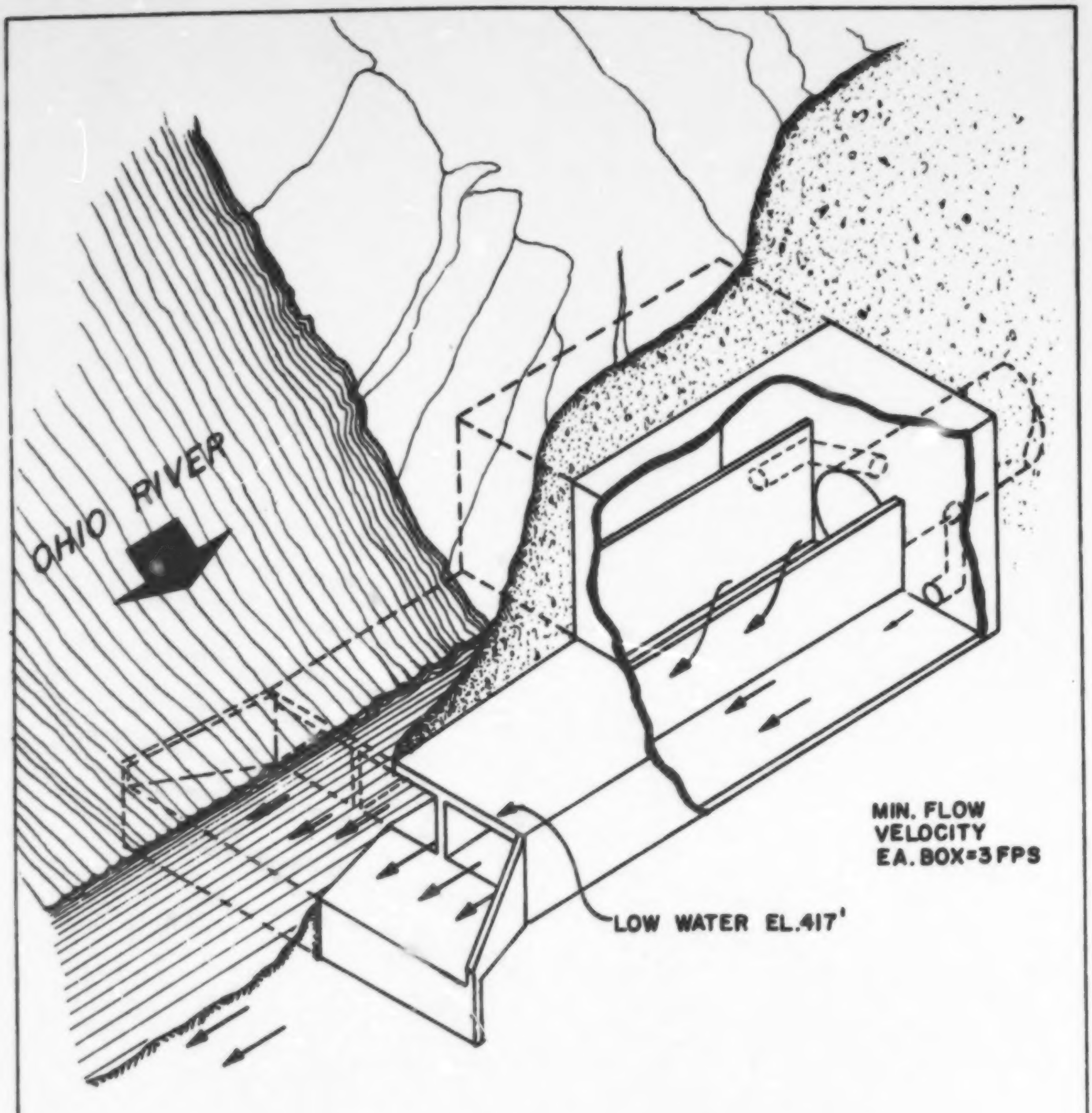
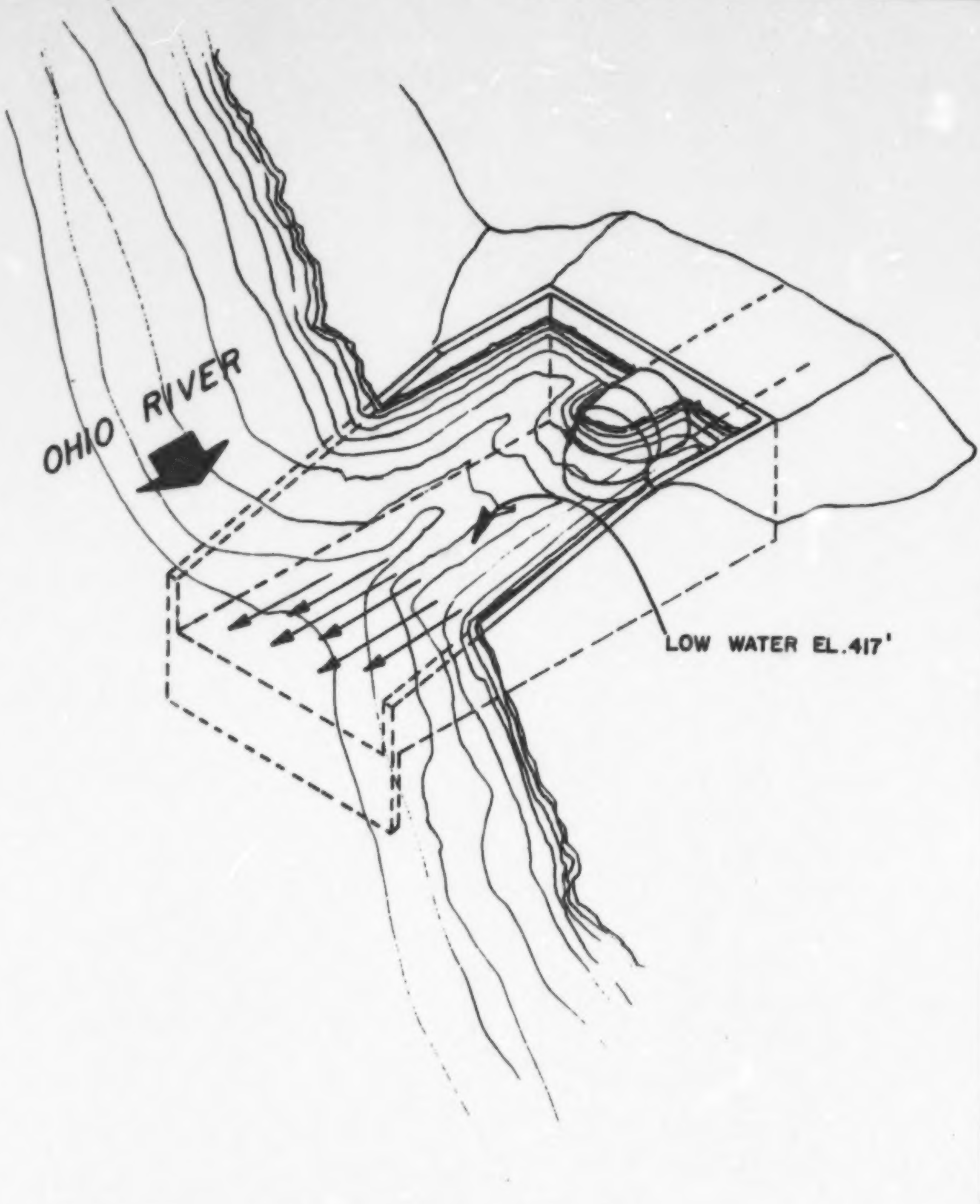
[a] Based on the use of Alston #1 raw coal.


OHIO RIVER
MIN. FLOW
VELOCITY
EA. BOX=3 FPS
LOW WATER EL.417'

DATE	**FLUOR PIONEER INC.**	STANDARD DETAIL
	LOUISVILLE GAS & ELECTRIC COMPANY TRIMBLE COUNTY PLANT SITE	SHT OF
PROJ. 31-7296	OUTLET STRUCTURE-ALTERNATIVE A	FIG. 3.4.4-9

FORM C-312 10/74


OHIO RIVER
LOW WATER EL.417'

DATE	**FLUOR PIONEER INC.**	STANDARD DETAIL
	LOUISVILLE GAS & ELECTRIC COMPANY TRIMBLE COUNTY PLANT SITE	SHT OF
PROJ. 31-7296	OUTLET STRUCTURE - ALTERNATIVE B	FIG. 3.4.4-10

FORM C-312 10/74

The chemical composition of solid waste is affected by the chemical properties of both the coal ash and the scrubber sludge. Typical ash components are silica, aluminum, and hematite, along with various amounts of minor and trace elements, some of which are toxic. Fly ash generally has a substantially higher trace-element content than bottom ash. The chemical properties of sludge can be broken down as follows:

1. Soluble trace metals
2. Chemical oxygen demand as a result of oxidation of sulfite to sulfate
3. High total dissolved solids
4. High levels of other major constituents such as sulfate, chloride, calcium, and magnesium
5. High suspended solids (some of which may dissolve at a later time)

Calcium compounds in the sludge have a limited solubility in the sludge liquors. The major chemical components of fly ash are even less soluble.

The trace elements in scrubber sludge and ash solids originate in the coal. Trace elements and other elements or compounds may also originate in other sources, such as the reactant, the makeup water, and/or the ash sluice water.

Dissolved compounds in the sludge and ash liquors have solubilities that are generally an inverse function of pH. The chemistry of the coal, particularly its chlorine and sulfur content, and the type of scrubber system employed determine the pH of the untreated sludge liquors.

Liquors associated with scrubber sludge may also contain species such as chlorides and certain trace metals that are volatilized during coal combustion and removed in the scrubber. (These species are unaffected by dry ash collection techniques.)

Limited data indicate that the amount of total dissolved solids (TDS) varies widely in sludge liquors and ash liquors. Levels of TDS in scrubber sludge liquors tend to be considerably higher, in some cases by an order of magnitude, than in ash transport liquors. The dissolved solids in these liquors include calcium, magnesium, chlorides, and other trace elements.

Alternative Disposal Schemes

The solid waste disposal schemes proposed for the Trimble County Generating Plant have undergone several major revisions. Initially, a base study (Figure 3.4.5-1) was performed to evaluate the amount of storage capacity available on the site. Bottom ash was designed to be stored in one compartment and fly ash and scrubber sludge in another.

However, it was determined that the amount of solid waste generated by the plant would exceed the capacity of any disposal pond that could be built on the bottomland portion of the site. This, coupled with the decision to solidify the scrubber sludge/fly ash mixture (see "Alternative Handling Schemes"), necessitated the identification of additional storage areas.

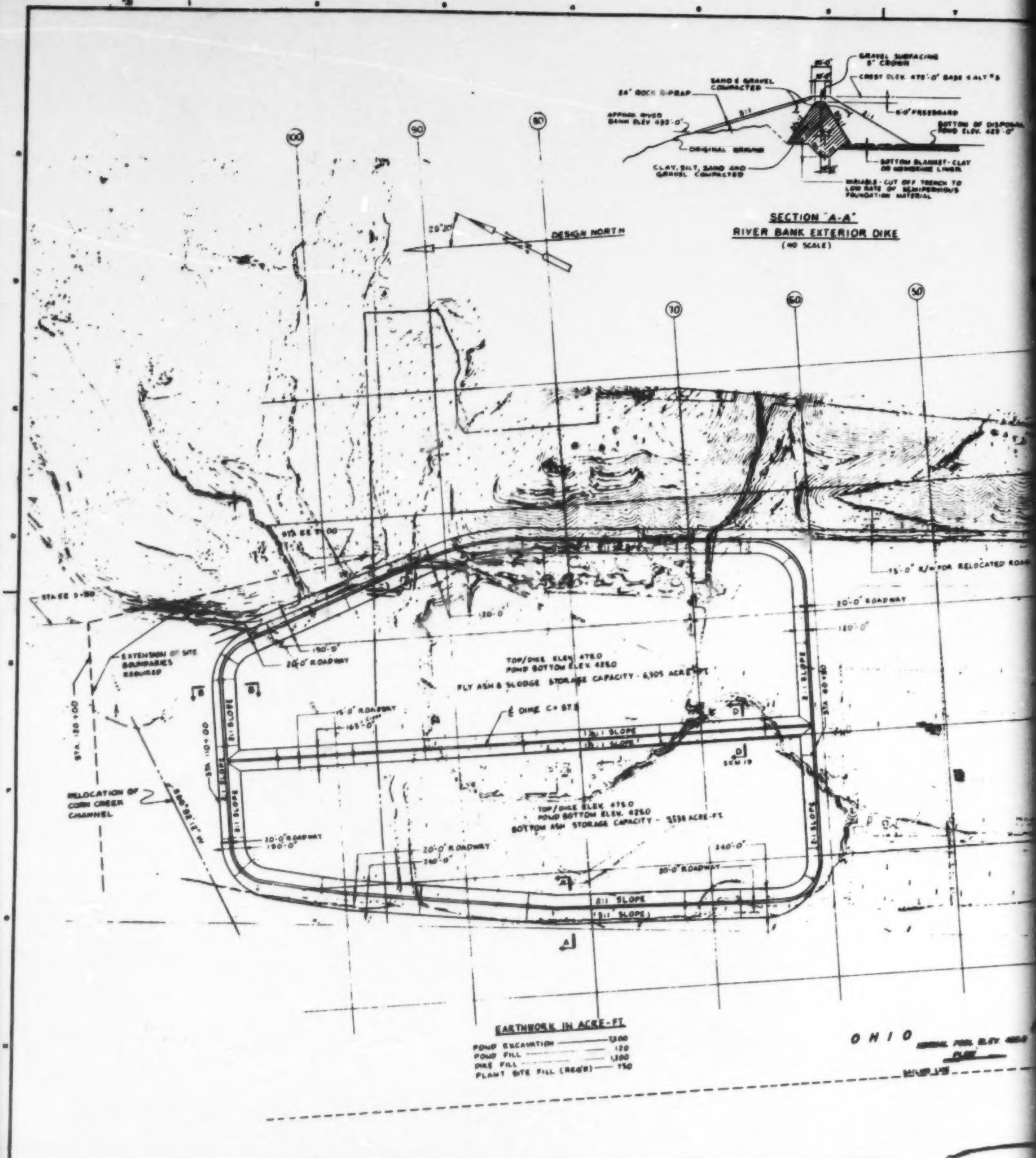
Subsequently, two ravines to the northeast of the site were selected as disposal areas for the 58,600 acre-feet of solidified scrubber sludge/fly ash to be produced by the plant during its 30-year life. The two ravines can provide up to 60,000 acre-feet of storage if both are filled to elevation 800.

Figures 3.4.5-2 through 3.4.5-4 depict the compartmentalized onsite disposal pond scheme that the Applicant developed to use in concert with the offsite storage ravines. One compartment was designed to provide storage for the 7,200 acre-feet of bottom ash that will be produced by the plant over its 30-year life. The other compartment was designed to provide up to 1 year of emergency storage of the scrubber sludge/fly ash, should the solid waste process plant be inoperable.

In order to construct this pond, however, the previously altered portion of Corn Creek would have to be relocated to the northern boundary of the site, and a wetlands area formed by the old cutoff channel of Corn Creek (the "oxbow") would be destroyed. The Corn Creek/oxbow area contains approximately 80 acres of bottomland woods. These provide a valuable habitat for the wildlife of the site and for migratory waterfowl (see Section 5.2.4).

Because the bottomland woods, particularly that along the oxbow, has an unusually high wildlife habitat value, the EPA and the Louisville District Corps of Engineers (which has jurisdiction over construction activities in wetland areas) requested the Applicant to evaluate other onsite disposal pond arrangements that would preserve the oxbow area and, if possible, eliminate the necessity of relocating Corn Creek.

Four potential arrangements were identified during a meeting of representatives of the Corps of Engineers, the EPA, the U.S. Fish and Wildlife Service, the Applicant, the Applicant's design engineering firm, and the environmental consultant preparing the EIS. These arrangements,depicted on Figures 3.4.5-5 through 3.4.5-10 and described in Table 3.4.5-1, were subsequently evaluated from an engineering point of view by the Applicant and the design engineering firm and from an environmental point of view by the environmental consultant. The results of the evaluations are presented in Table 3.4.5-2. A breakdown of the approximate costs associated with the originally proposed arrangement versus the four alternatives is presented in Table 3.4.5-3. From a design standpoint, the chief criterion for the disposal pond is provision of an adequate storage capacity for both the bottom ash and scrubber sludge/fly ash (during periods when the solid waste process plant is inoperable).


GRAVEL SURFACING
3" CROWN
CREST ELEV. 475'-0" BASE 4 ALT *3
SAND & GRAVEL COMPACTED
24" ROCK RIPRAP
APPROX. RIVER BANK ELEV. 433'-0"
6'-0" FREEBOARD
BOTTOM OF DISPOSAL POND ELEV. 425'-0"
ORIGINAL GROUND
CLAY, SILT, SAND AND GRAVEL COMPACTED
BOTTOM BLANKET - CLAY OR MEMBRANE LINER
VARIABLE - CUT OFF TRENCH TO LOW RATE OF SEMIPERVIOUS FOUNDATION MATERIAL
3:1
2:1
SECTION "A-A"
RIVER BANK EXTERIOR DIKE
(NO SCALE)
DESIGN NORTH
100
90
80
70
60
50
STA. 88+00
STAGE 3-80
150'-0"
20'-0" ROADWAY
120'-0"
15'-0" R/W FOR RELOCATED ROAD
20'-0" ROADWAY
120'-0"
EXTENSION OF SITE BOUNDARIES REQUIRED
TOP/DIKE ELEV. 475.0
POND BOTTOM ELEV. 425.0
FLY ASH & SLUDGE STORAGE CAPACITY - 6,105 ACRE-FT.
B
B
15'-0" ROADWAY
165'-0"
℄ DIKE C+87.5
1½:1 SLOPE
1½:1 SLOPE
2:1 SLOPE
2:1 SLOPE
3:1 SLOPE
STA. 110+00
STA. 120+00
STA. 60+00
D
D
BKM 19
RELOCATION OF CORN CREEK CHANNEL
TOP/DIKE ELEV. 475.0
POND BOTTOM ELEV. 425.0
BOTTOM ASH STORAGE CAPACITY - 3538 ACRE-FT.
20'-0" ROADWAY
190'-0"
20'-0" ROADWAY
240'-0"
240'-0"
20'-0" ROADWAY
A
A
2:1 SLOPE
3:1 SLOPE
EARTHWORK IN ACRE-FT
POND EXCAVATION — 1,300
POND FILL — 120
DIKE FILL — 1,300
PLANT SITE FILL (REQ'D) — 750
OHIO
NORMAL POOL ELEV. 455.0
FLOW
SAILING LINE

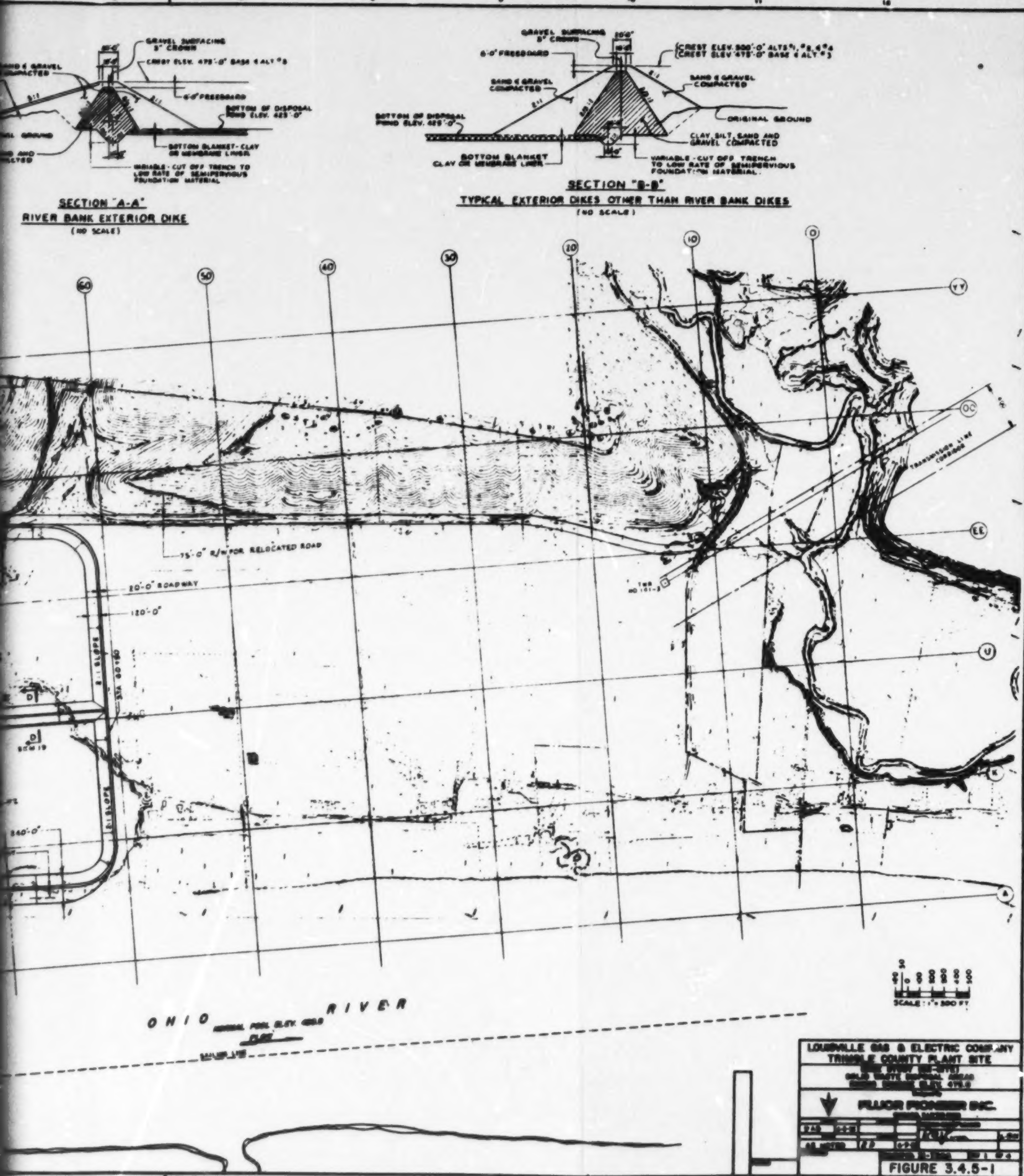
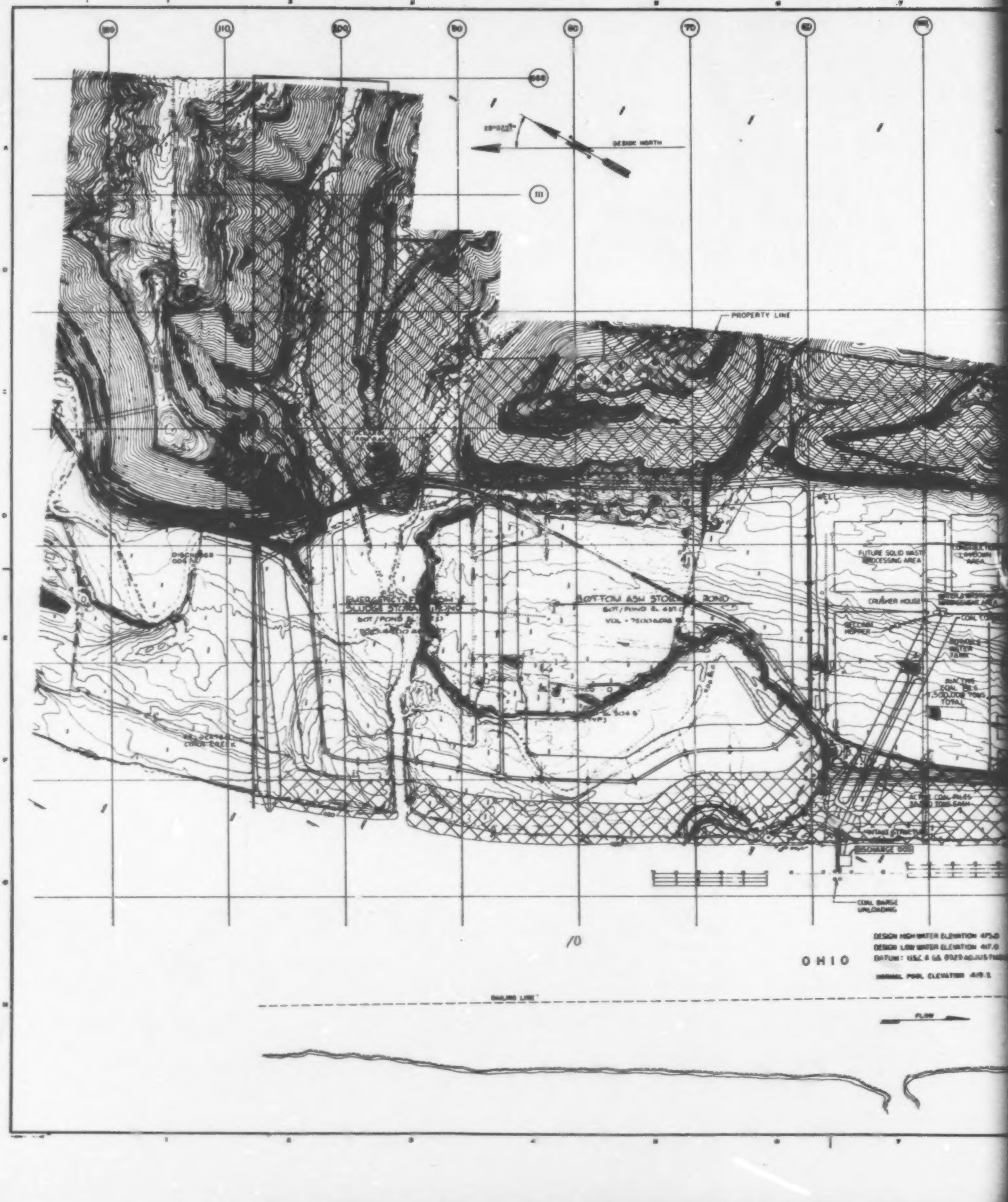
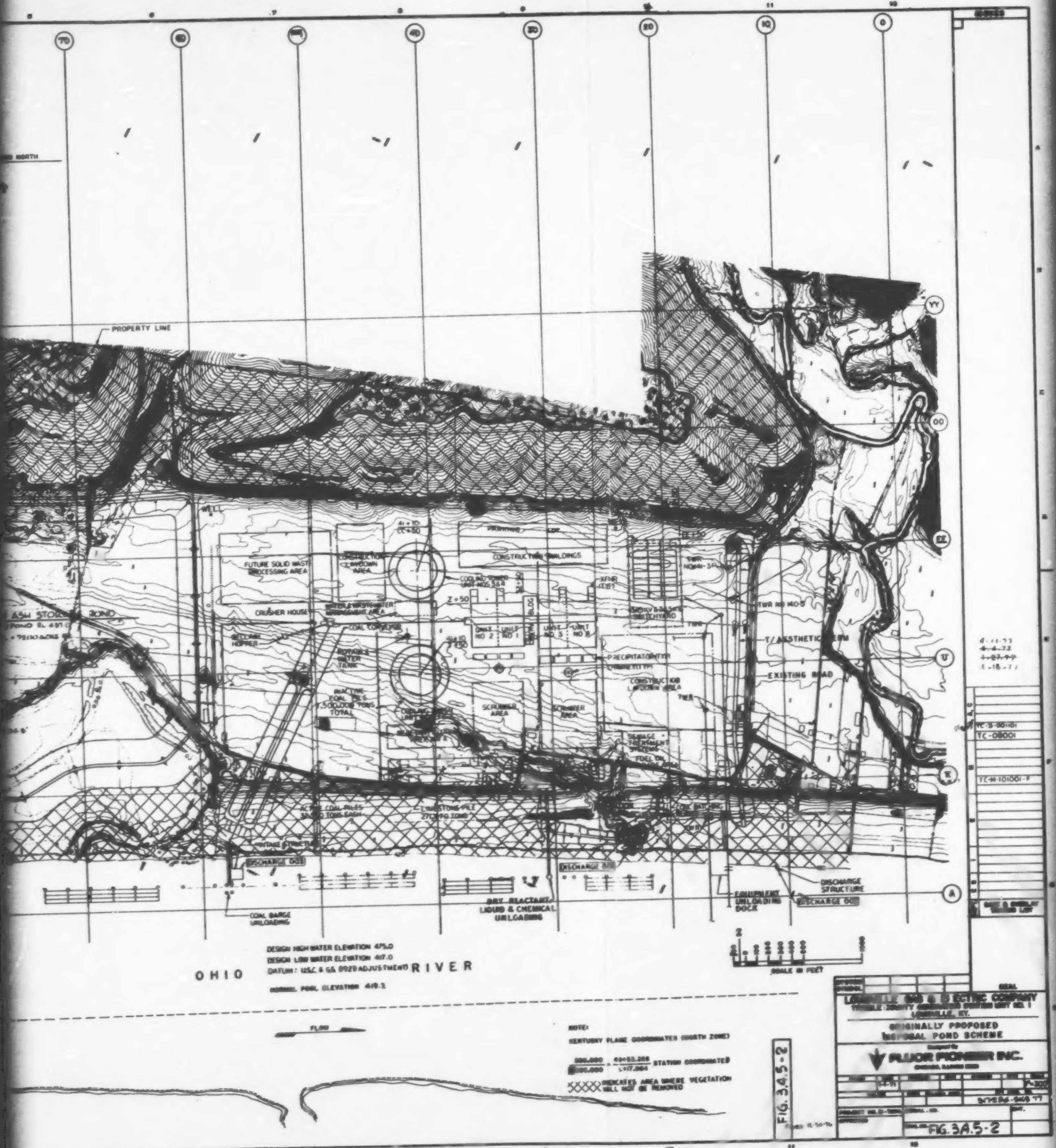

GRAVEL SURFACING
3" CROWN
CREST ELEV. 475'-0" BASE & ALT. #3
SAND & GRAVEL
COMPACTED
3:1
6'-0" FREEBOARD
BOTTOM OF DISPOSAL
POND ELEV. 425'-0"
BOTTOM BLANKET-CLAY
OR MEMBRANE LINER
VARIABLE-CUT OFF TRENCH TO
LOW RATE OF SEMIPERVIOUS
FOUNDATION MATERIAL
SECTION "A-A"
RIVER BANK EXTERIOR DIKE
(NO SCALE)
GRAVEL SURFACING
3" CROWN
20'-0"
6'-0" FREEBOARD
(CREST ELEV. 500'-0" ALTS #1, #2, & #4
(CREST ELEV. 475'-0" BASE & ALT. #3)
2:1
SAND & GRAVEL
COMPACTED
ORIGINAL GROUND
BOTTOM OF DISPOSAL
POND ELEV. 425'-0"
CLAY, SILT, SAND AND
GRAVEL COMPACTED
BOTTOM BLANKET
CLAY OR MEMBRANE LINER
VARIABLE-CUT OFF TRENCH
TO LOW RATE OF SEMIPERVIOUS
FOUNDATION MATERIAL.
SECTION "B-B"
TYPICAL EXTERIOR DIKES OTHER THAN RIVER BANK DIKES
(NO SCALE)
60
50
40
30
20
10
0
YY
CC
EE
U
K
A
TRANSMISSION LINE
CORRIDOR
75'-0" R/W FOR RELOCATED ROAD
20'-0" ROADWAY
120'-0"
2:1 SLOPE
340'-0"
OHIO
RIVER
SCALE: 1" = 300 FT
LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE
SOLID WASTE DISPOSAL AREAS
FLUOR PIONEER INC.
AS NOTED

FIGURE 3.4.5-1


120
110
100
90
80
70
60
DESIGN NORTH
PROPERTY LINE
WELL
DISCHARGE 004
FUTURE SOLID WASTE PROCESSING AREA
CRUSHER HOUSE
COAL CO
GYPSUM HOPPER
WATER TANK
INACTIVE COAL PILES 350,000 TONS TOTAL
EMERGENCY FLOW & SLUDGE STORAGE POND
BOT/POND EL
BOTTOM ASH STORAGE POND
BOT/POND EL 487.0
VOL
ACTIVE COAL PILES
INTAKE STRUCTURE
DISCHARGE 001
COAL BARGE UNLOADING
10
OHIO
DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS 1929 ADJUSTMENT
NORMAL POOL ELEVATION 419.1
SAILING LINE
FLOW


70
60
40
30
20
10
0
NORTH
PROPERTY LINE
YY
OO
EE
U
A
WELL
41+10
CC+50
PARKING
CONSTRUCTION BUILDINGS
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION LAYDOWN AREA
COOLING TOWER UNIT NOS 3 & 4
XFMR
Z+50
CRUSHER HOUSE
WATER & WASTEWATER TREATMENT AREA
COAL CONVEYOR
RECLAIM HOPPER
POTABLE WATER TANK
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO 4
BLDG
SWITCHYARD
TWR NO 141-3
TWR NO 140-5
TWR
T/ AESTHETIC BERM
PRECIPITATOR (TYP)
CHIMNEY (TYP)
EXISTING ROAD
CONSTRUCTION LAYDOWN AREA
INACTIVE COAL PILE 1,500,000 TONS TOTAL
COOLING TOWER
SCRUBBER AREA
SCRUBBER AREA
SEWAGE TREATMENT SYSTEMS
FUEL OIL
ASH STORAGE POND
ACTIVE COAL PILES
LIMESTONE PILE
COAL BATCHING
INTAKE STRUCTURE
DISCHARGE 001
DISCHARGE 001
DISCHARGE 001
COAL BARGE UNLOADING
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
DISCHARGE STRUCTURE
OHIO RIVER
FLOW
SCALE IN FEET
TC-5-00101
TC-00001
TC-H-101001-F
6-11-77
4-4-77
1-27-77
1-18-77

DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS 1929 ADJUSTMENT
NORMAL POOL ELEVATION 419.2

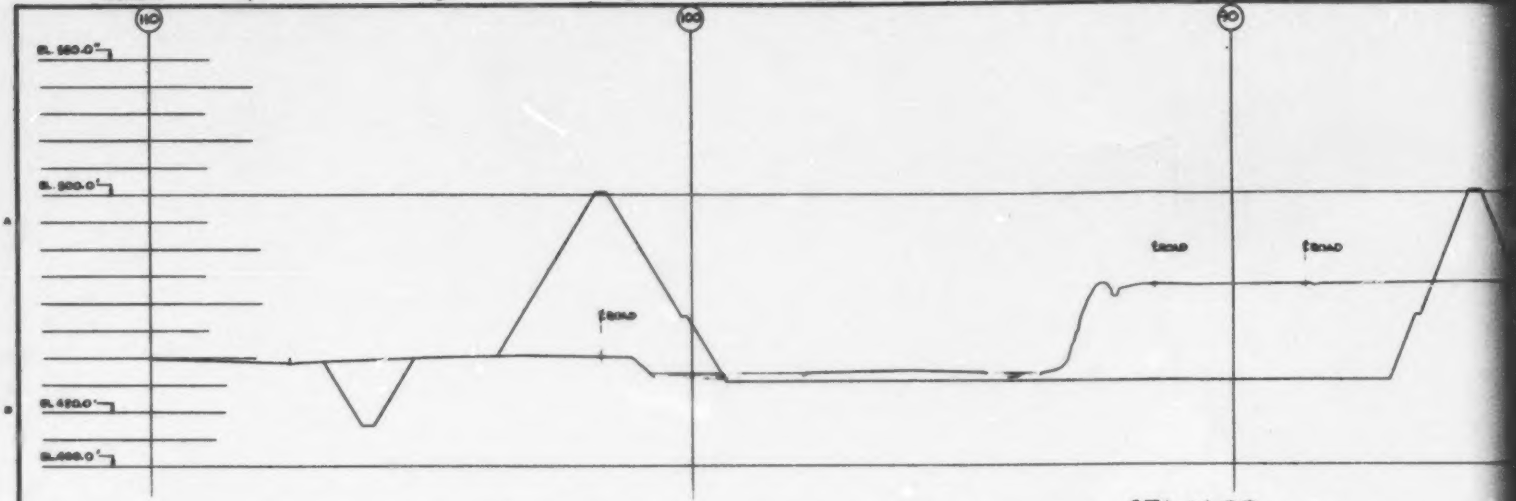
NOTE:
KENTUCKY PLANE COORDINATES (NORTH ZONE)
200,000 / 100,000 = 40+53.208 / L+17.004 STATION COORDINATES
XXXXX INDICATES AREA WHERE VEGETATION WILL NOT BE REMOVED

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.

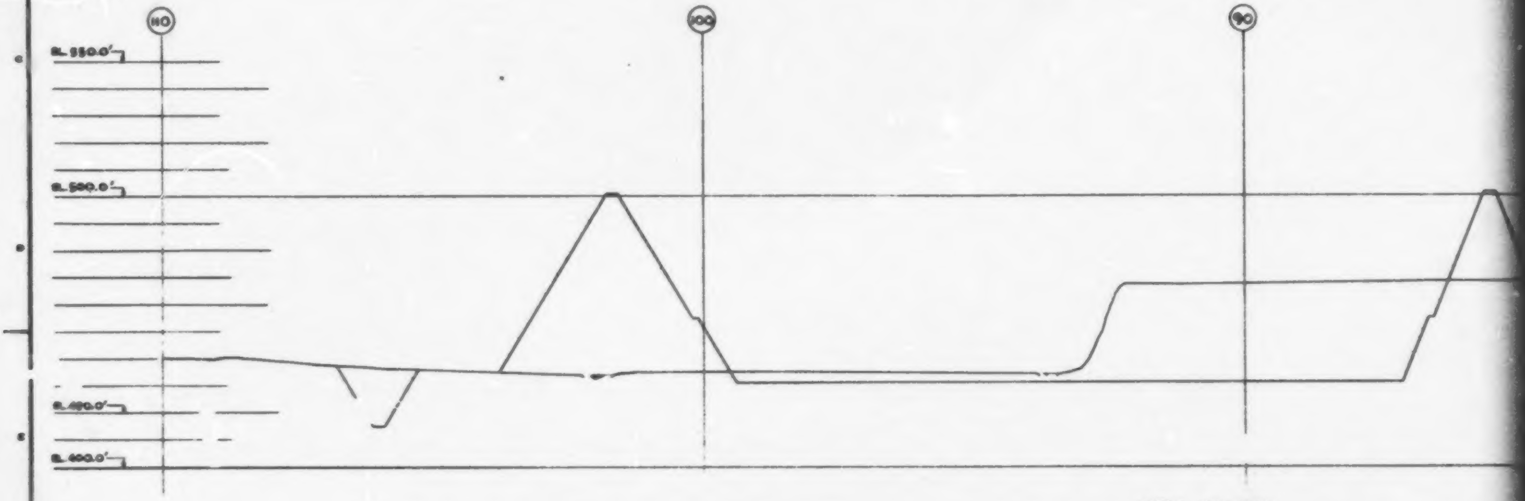
ORIGINALLY PROPOSED
DISPOSAL POND SCHEME

FLUOR PIONEER INC.

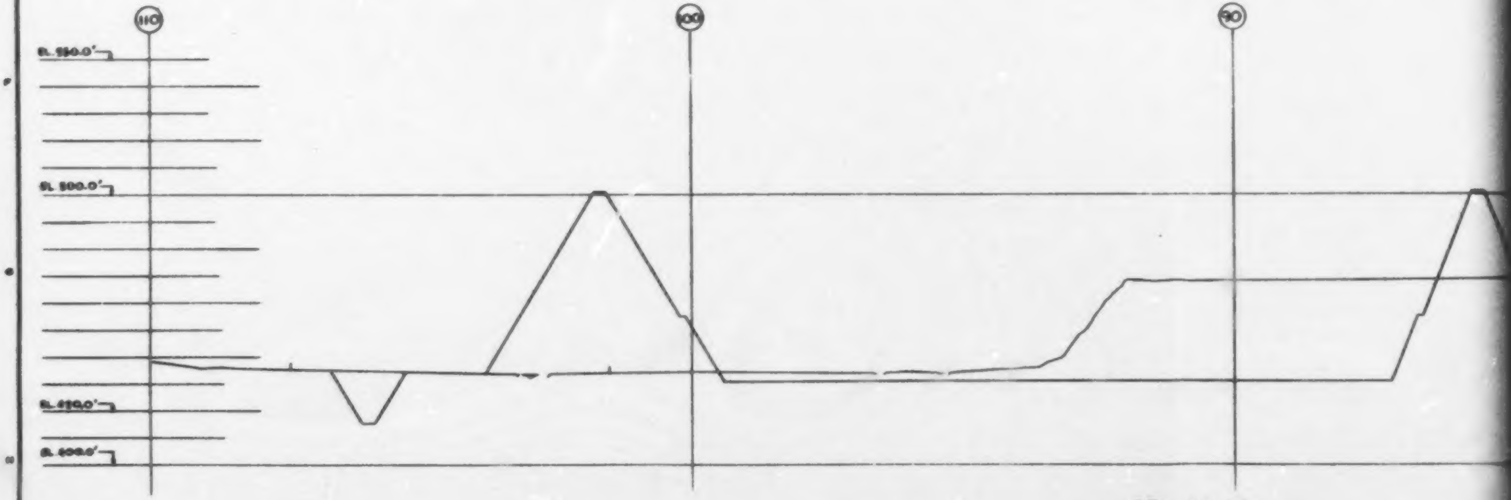
FIG. 3A.5-2


110
100
90
EL. 550.0'
EL. 500.0'
EL. 420.0'
EL. 400.0'
℄ ROAD
℄ ROAD
℄ ROAD

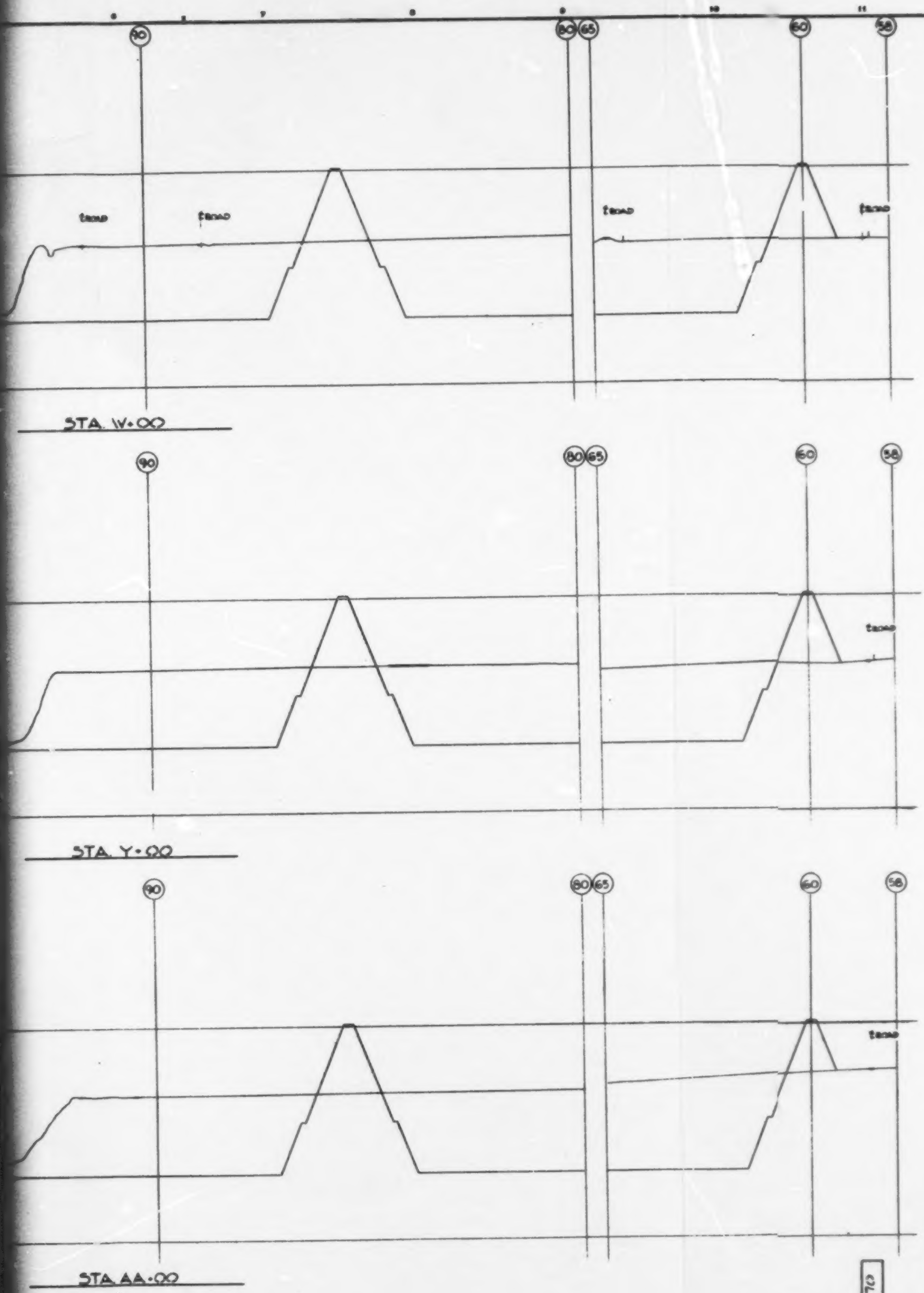
STA. W+00


110
100
90
EL. 550.0'
EL. 500.0'
EL. 420.0'
EL. 400.0'

STA. Y+00


110
100
90
EL. 550.0'
EL. 500.0'
EL. 420.0'
EL. 400.0'

STA. AA+00



90
80
65
60
58
℄ ROAD
℄ ROAD
℄ ROAD
℄ ROAD
STA. W+00
90
80
65
60
58
℄ ROAD
STA. Y+00
90
80
65
60
58
℄ ROAD
STA. AA+00

ORIGINAL
SCHEME

SYSTEM
SYMBOL

SEAL

BASE & OVERLAY
FOGGING LIST

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.

ASH POND CROSS-SECTIONS
STA W+00, Y+00, AA+00

Designed By
FLUOR PIONEER INC.
CHICAGO ILLINOIS

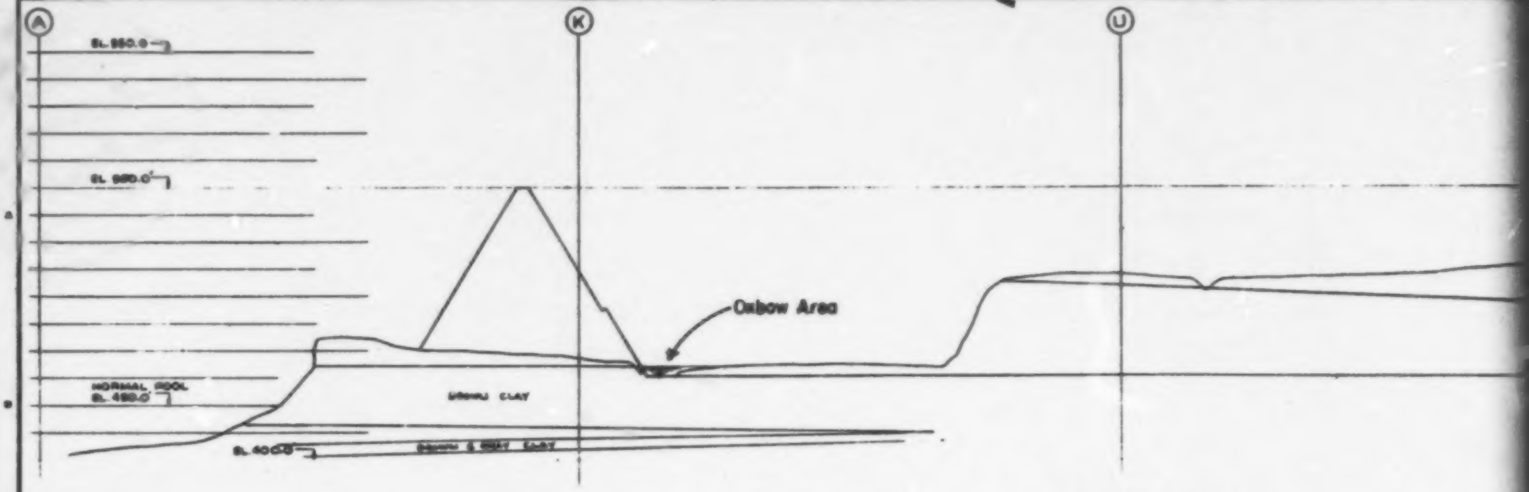
LGE-TC-00-PPD-0160

PROJECT NO. 3-7296

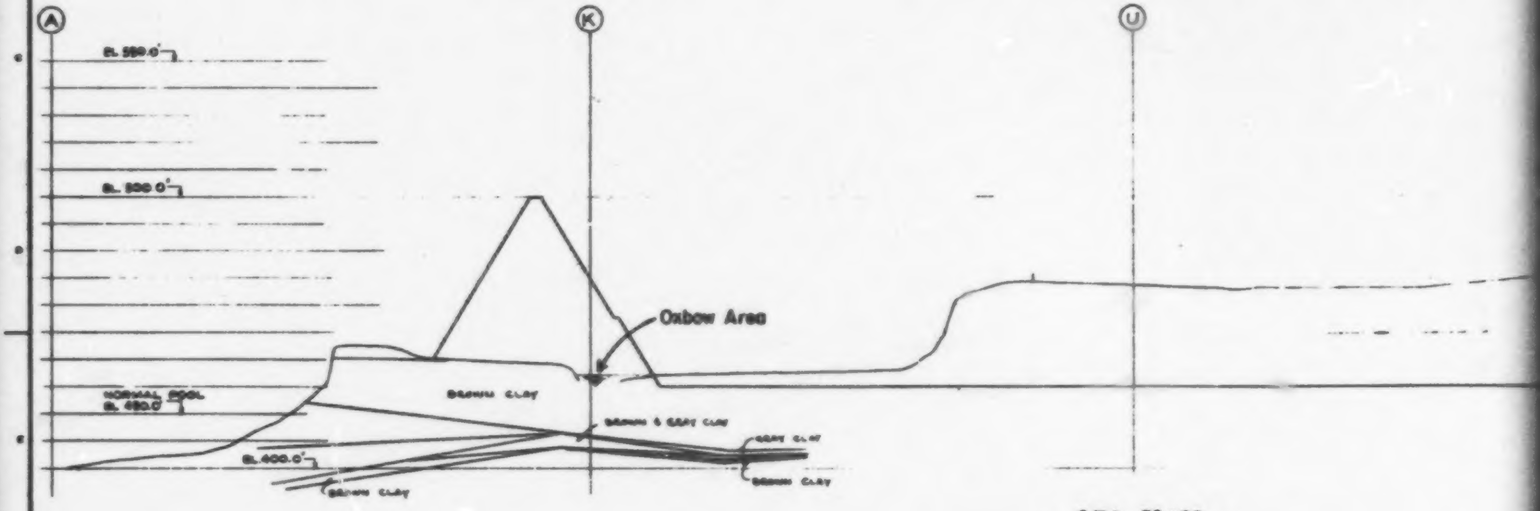
APPROVED

FIGURE 3.4.5-3

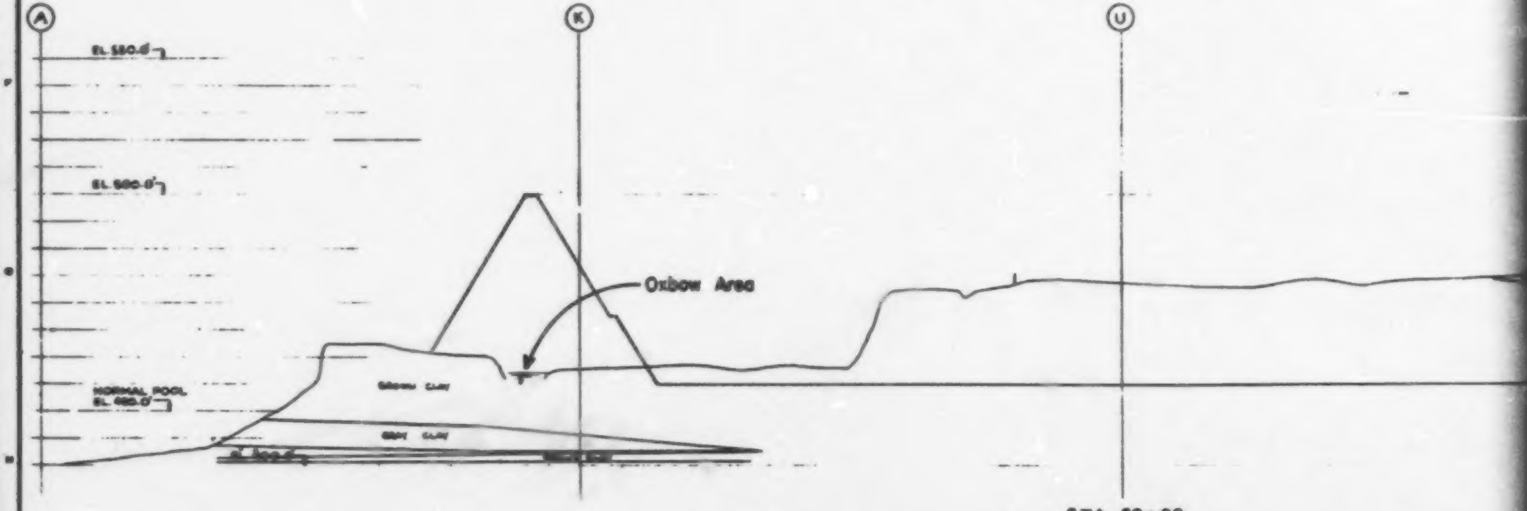
317296-3K97C


A
K
U
EL. 550.0'
EL. 500.0'
Oxbow Area
NORMAL POOL EL. 450.0'
BROWN CLAY
EL. 400.0'
BROWN & GRAY CLAY

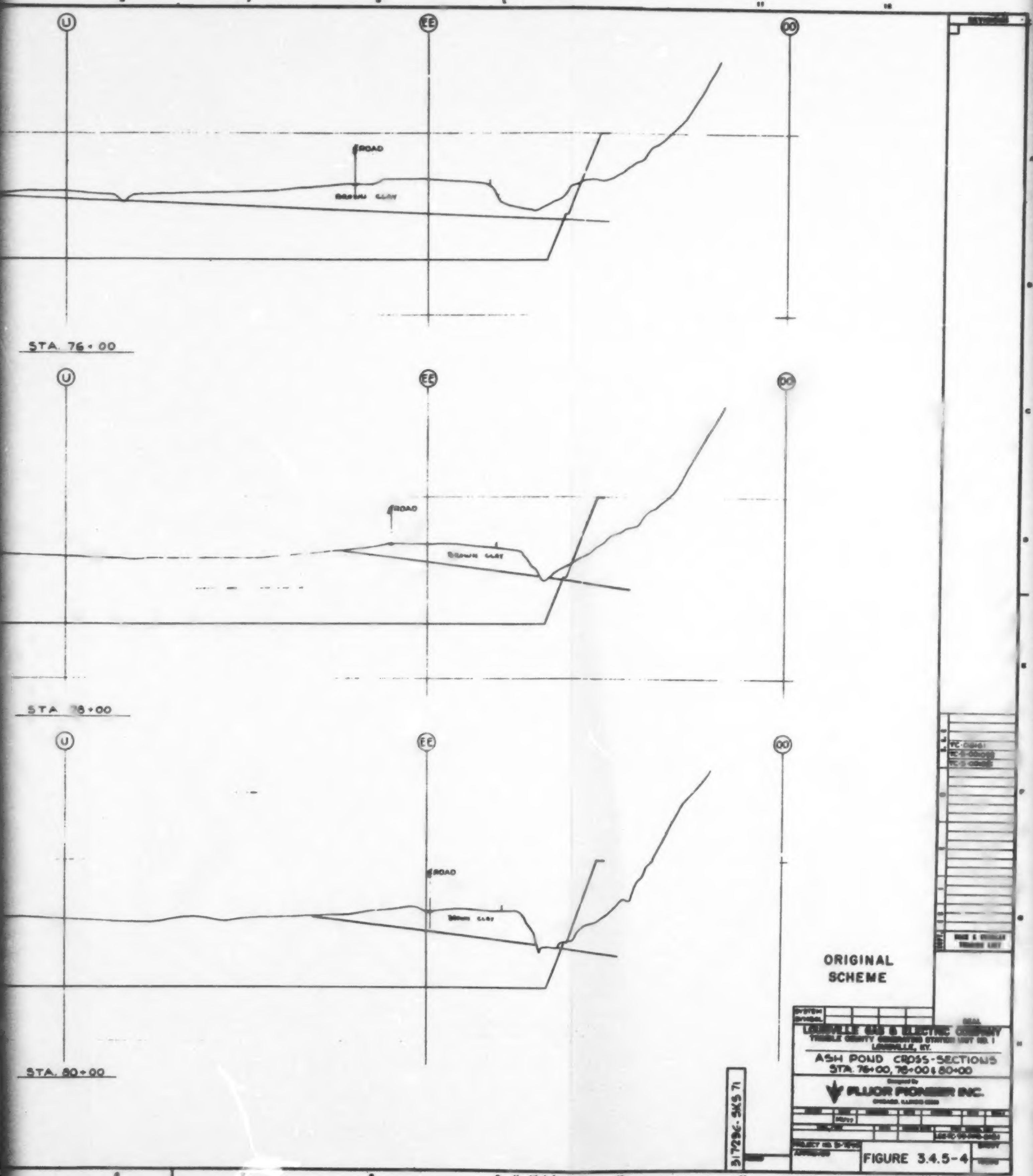
STA. 76+00


A
K
U
EL. 550.0'
EL. 500.0'
Oxbow Area
NORMAL POOL EL. 450.0'
BROWN CLAY
BROWN & GRAY CLAY
GRAY CLAY
EL. 400.0'
BROWN CLAY
BROWN CLAY

STA 78+00

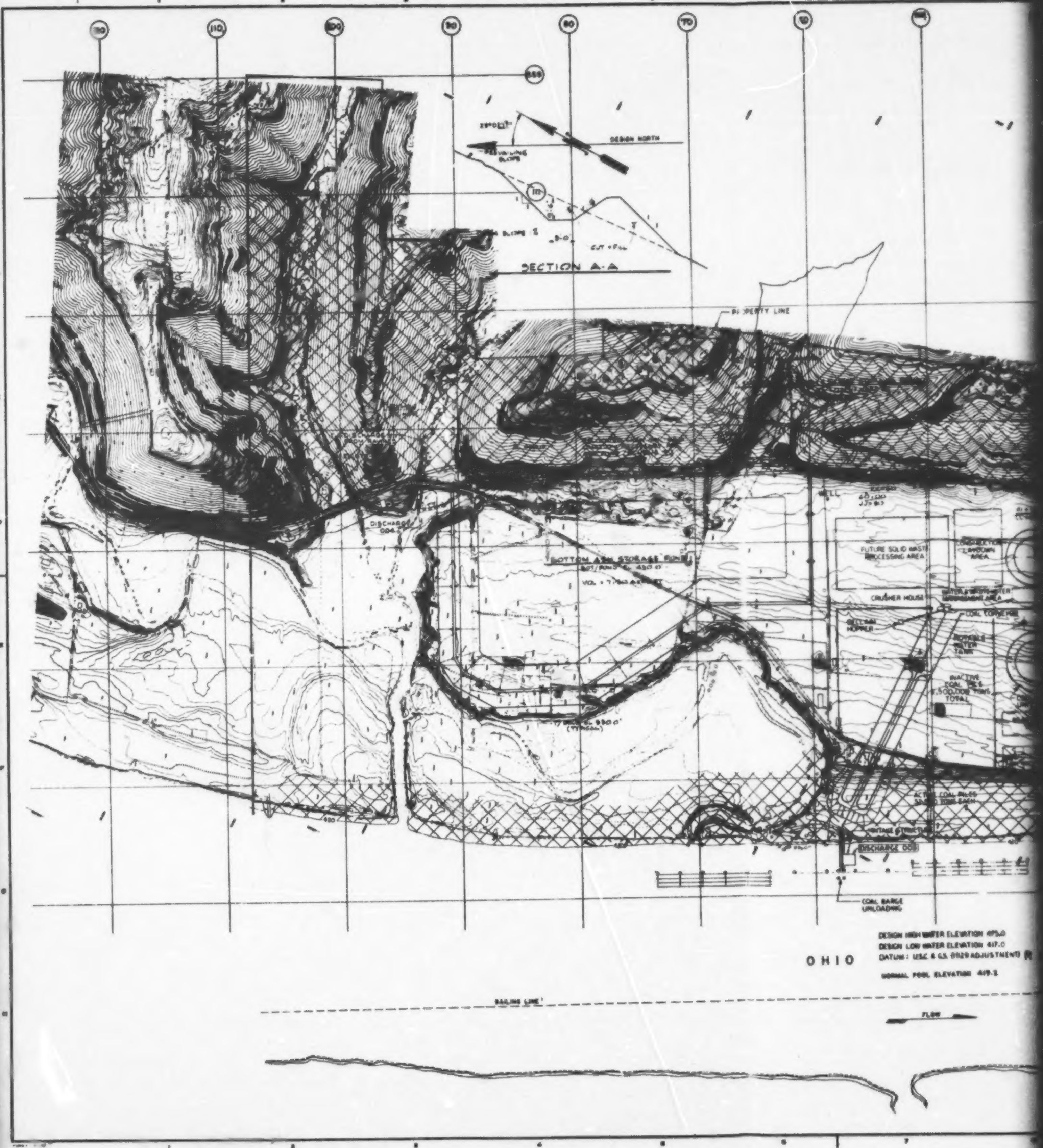

A
K
U
EL. 550.0'
EL. 500.0'
Oxbow Area
NORMAL POOL EL. 450.0'
BROWN CLAY
GRAY CLAY
EL. 400.0'

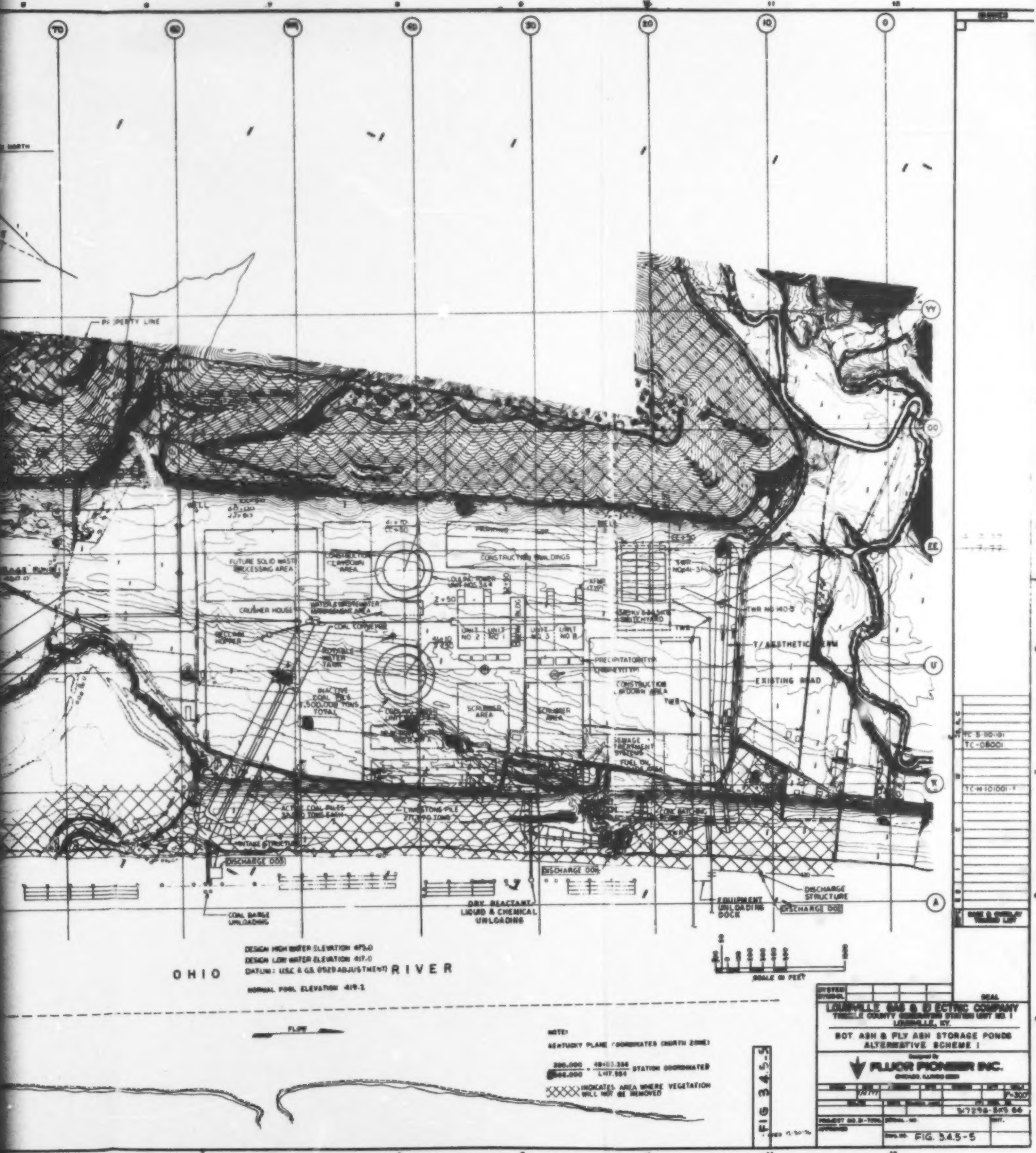
STA. 80+00


U
EE
OO
ROAD
BROWN CLAY
STA. 76+00
STA. 78+00
STA. 80+00
ORIGINAL
SCHEME
LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.
FLUOR PIONEER INC.
317296-SKS 71

ASH POND CROSS-SECTIONS
STA. 76+00, 78+00 & 80+00

FIGURE 3.4.5-4

130
110
100
90
80
70
60
50
350
25°01'17"
DESIGN NORTH
PREVAILING SLOPE
111
SLOPE 2
CUT & FILL
SECTION A-A
PROPERTY LINE
WELL
DISCHARGE 006
BOTTOM ASH STORAGE POND
VOL. = 7,700 AC-FT
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION LAYDOWN AREA
CRUSHER HOUSE
WATER & WASTEWATER TREATMENT AREA
COAL CONVEYOR
RECLAIM HOPPER
POTABLE WATER TANK
INACTIVE COAL PILES 1,500,000 TONS TOTAL
ACTIVE COAL PILES 35,000 TONS EACH
INTAKE STRUCTURE
DISCHARGE 001
COAL BARGE UNLOADING
420
DESIGN HIGH WATER ELEVATION 675.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS (1929 ADJUSTMENT)
NORMAL POOL ELEVATION 419.2
OHIO
SAILING LINE
FLOW
1
2
3
4
5
6
7


70
60
50
40
30
20
10
0
PROPERTY LINE
WELL
CONSTRUCTION BUILDINGS
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION LAYDOWN AREA
COOLING TOWER UNIT NOS. 3 & 4
CRUSHER HOUSE
COAL CONVEYOR
RECLAIM HOPPER
POTABLE WATER TANK
INACTIVE COAL PILES 1,500,000 TONS TOTAL
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO B
PRECIPITATOR (TYP)
SCRUBBER AREA
XFMR (TYP)
SWITCHYARD
TWR NO. 41-3
TWR NO 140-5
TWR
T/AESTHETIC BERM
EXISTING ROAD
CONSTRUCTION LAYDOWN AREA
SEWAGE TREATMENT STATION
FUEL OIL
ACTIVE COAL PILES
LIMESTONE PILE
INTAKE STRUCTURE
DISCHARGE 001
DISCHARGE 004
DISCHARGE 003
DISCHARGE STRUCTURE
COAL BARGE UNLOADING
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
YY
OO
EE
U
K
A
TC-S-00101
TC-08001
TC-M-101001
OHIO RIVER
DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: U.S.C. & G.S. (1929 ADJUSTMENT)
NORMAL POOL ELEVATION 419.2
FLOW
SCALE IN FEET
NOTE:
KENTUCKY PLANE COORDINATES (NORTH ZONE)
STATION COORDINATES
INDICATES AREA WHERE VEGETATION WILL NOT BE REMOVED
FIG. 3.4.5-5
SEAL

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.

BOT. ASH & FLY ASH STORAGE PONDS
ALTERNATIVE SCHEME I

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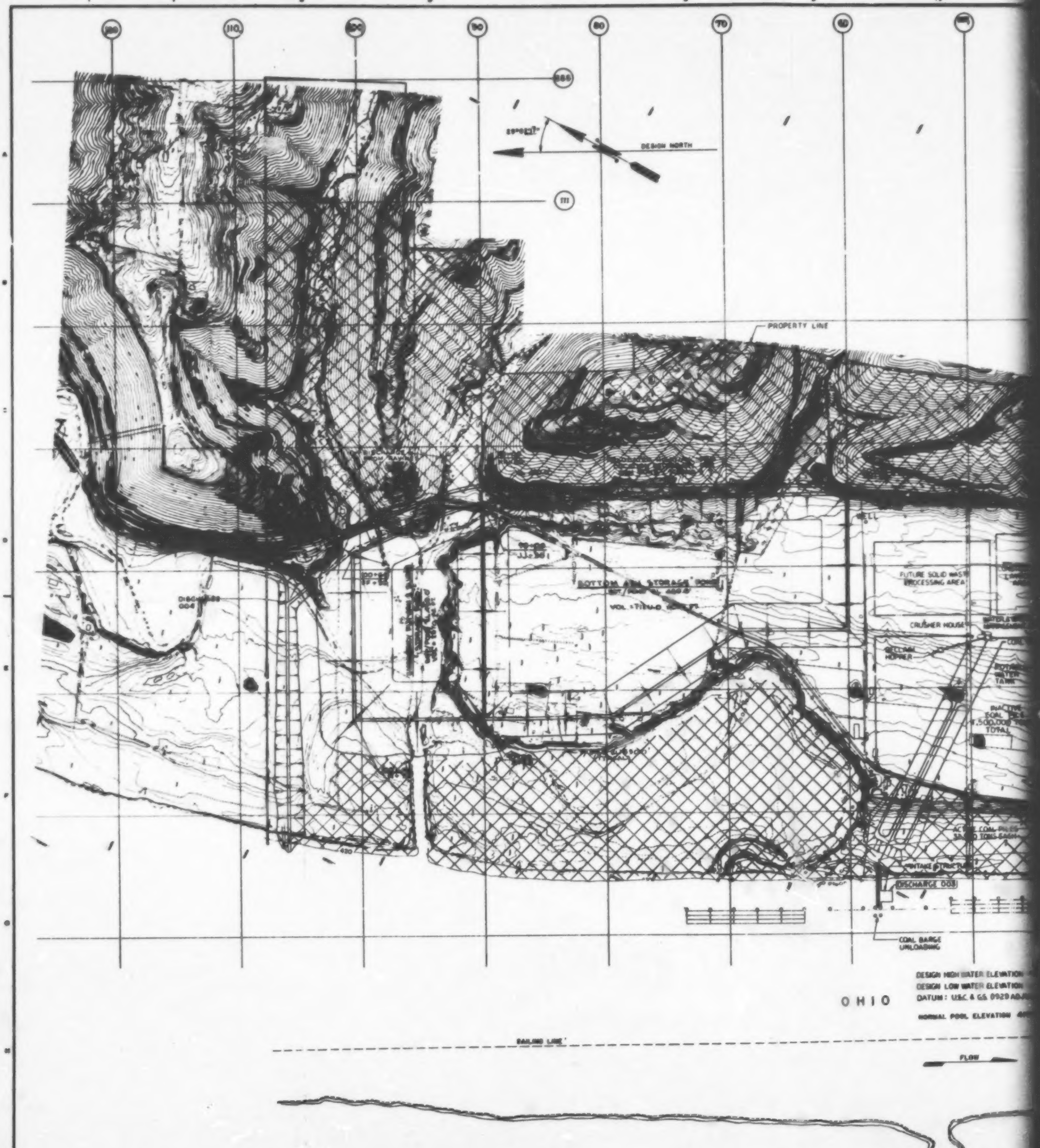
CHICAGO, ILLINOIS

7-300

517296-SK9 66

DWG. NO. FIG. 3.4.5-5


120
110
100
90
80
70
60
886
111
DESIGN NORTH
PROPERTY LINE
BOTTOM ASH STORAGE POND
VOL.
WELL
FUTURE SOLID WASTE PROCESSING AREA
CRUSHER HOUSE
RECLAIM HOPPER
INACTIVE COAL PILE
1,500,000 TONS TOTAL
ACTIVE COAL PILES
INTAKE STRUCTURE
DISCHARGE 003
COAL BARGE UNLOADING
OHIO
SAILING LINE
DESIGN HIGH WATER ELEVATION
DESIGN LOW WATER ELEVATION
DATUM: U.S.C. & G.S. 1929 ADJ
NORMAL POOL ELEVATION
FLOW
1
2
3
4
5
6
7

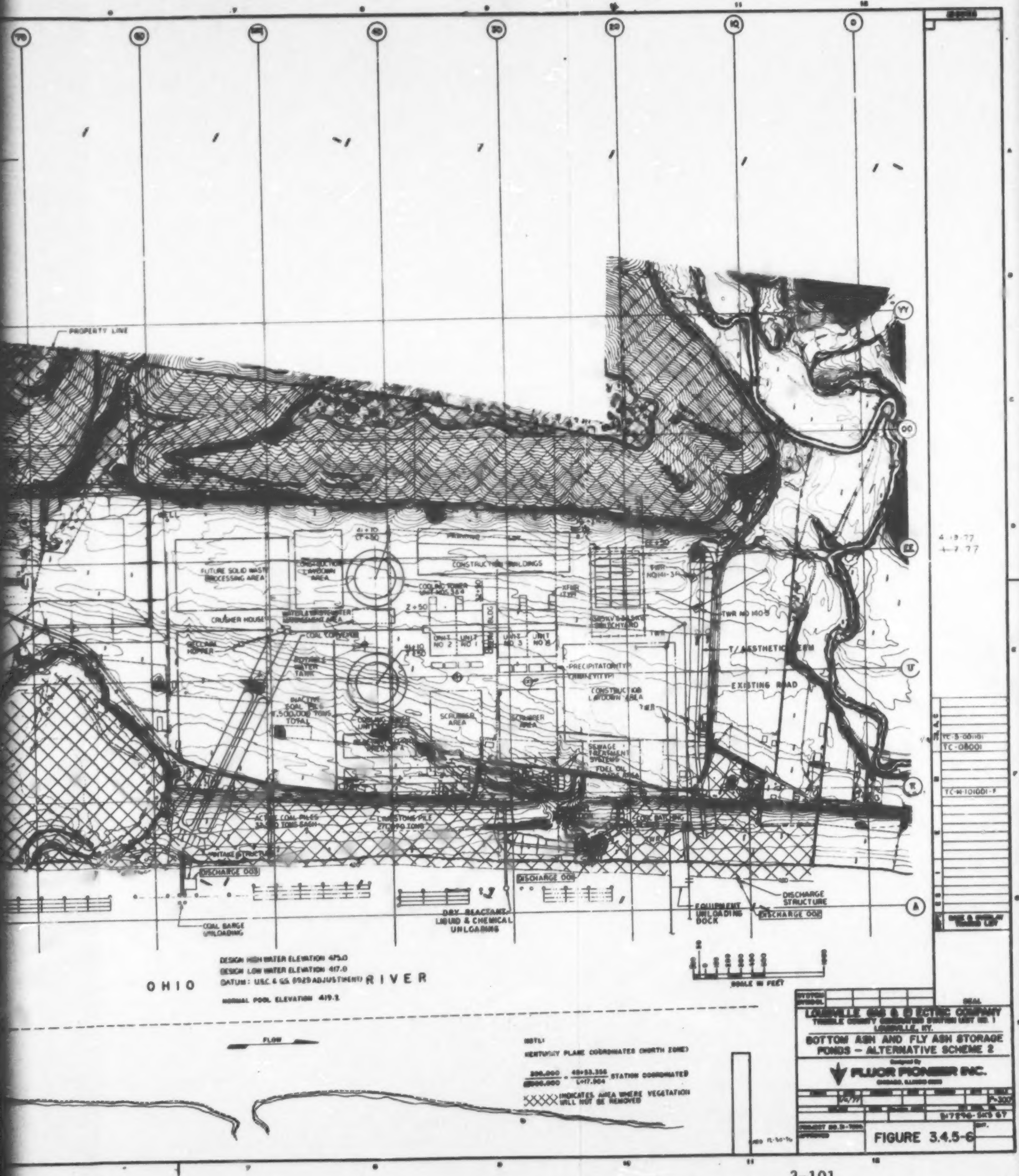
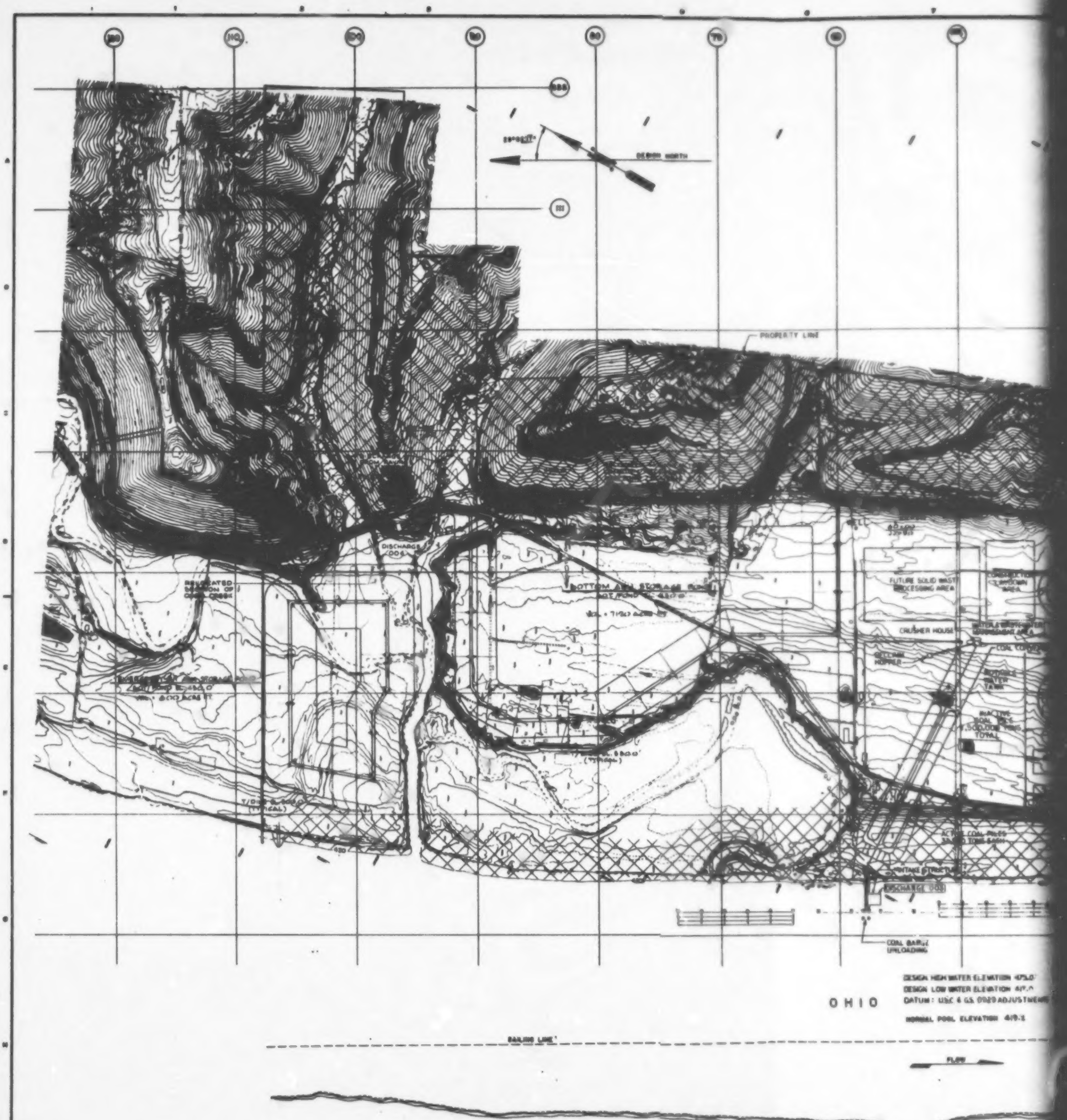

PROPERTY LINE
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION LAYDOWN AREA
CONSTRUCTION BUILDINGS
COOLING TOWER
CRUSHER HOUSE
COAL CONVEYOR
RECLAIM HOPPER
ROTATING WATER TANK
INACTIVE COAL PILE 1,500,000 TONS TOTAL
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO 4
SCRUBBER AREA
PRECIPITATOR(TYP)
CHIMNEY(TYP)
CONSTRUCTION LAYDOWN AREA
SEWAGE TREATMENT SYSTEMS
FUEL OIL
TWR NO 140-5
T/AESTHETIC BERM
EXISTING ROAD
ACTIVE COAL PILES
LIMESTONE PILE
INTAKE STRUCTURE
DISCHARGE 003
DISCHARGE 001
DISCHARGE 002
COAL BARGE UNLOADING
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
DISCHARGE STRUCTURE
DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS 1929 ADJUSTMENT)
OHIO RIVER
NORMAL POOL ELEVATION 419.1
FLOW
SCALE IN FEET
NOTE:
KENTUCKY PLANE COORDINATES (NORTH ZONE)
STATION COORDINATES
INDICATES AREA WHERE VEGETATION WILL NOT BE REMOVED
4-19-77
4-7-77
TC-5-00101
TC-08001
TC-H-101001-F
SEAL
LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.
BOTTOM ASH AND FLY ASH STORAGE PONDS – ALTERNATIVE SCHEME 2
Designed By
FLUOR PIONEER INC.
CHICAGO, ILLINOIS
P-300
917596-SK3 67

FIGURE 3.4.5-6


DESIGN NORTH
PROPERTY LINE
DISCHARGE 006
RELOCATED SECTION OF [illegible] CREEK
BOTTOM ASH STORAGE POND
T/DIKE EL. 500.0 (TYPICAL)
FUTURE SOLID WASTE PROCESSING AREA
CRUSHER HOUSE
RECLAIM HOPPER
INACTIVE COAL PILES 1,500,000 TONS TOTAL
ACTIVE COAL PILES
INTAKE STRUCTURE
DISCHARGE 003
COAL BARGE UNLOADING
DESIGN HIGH WATER ELEVATION 475.0'
DESIGN LOW WATER ELEVATION 417.0
DATUM: U.S.C. & G.S. 1929 ADJUSTMENT
NORMAL POOL ELEVATION 419.1
OHIO
SAILING LINE
FLOW

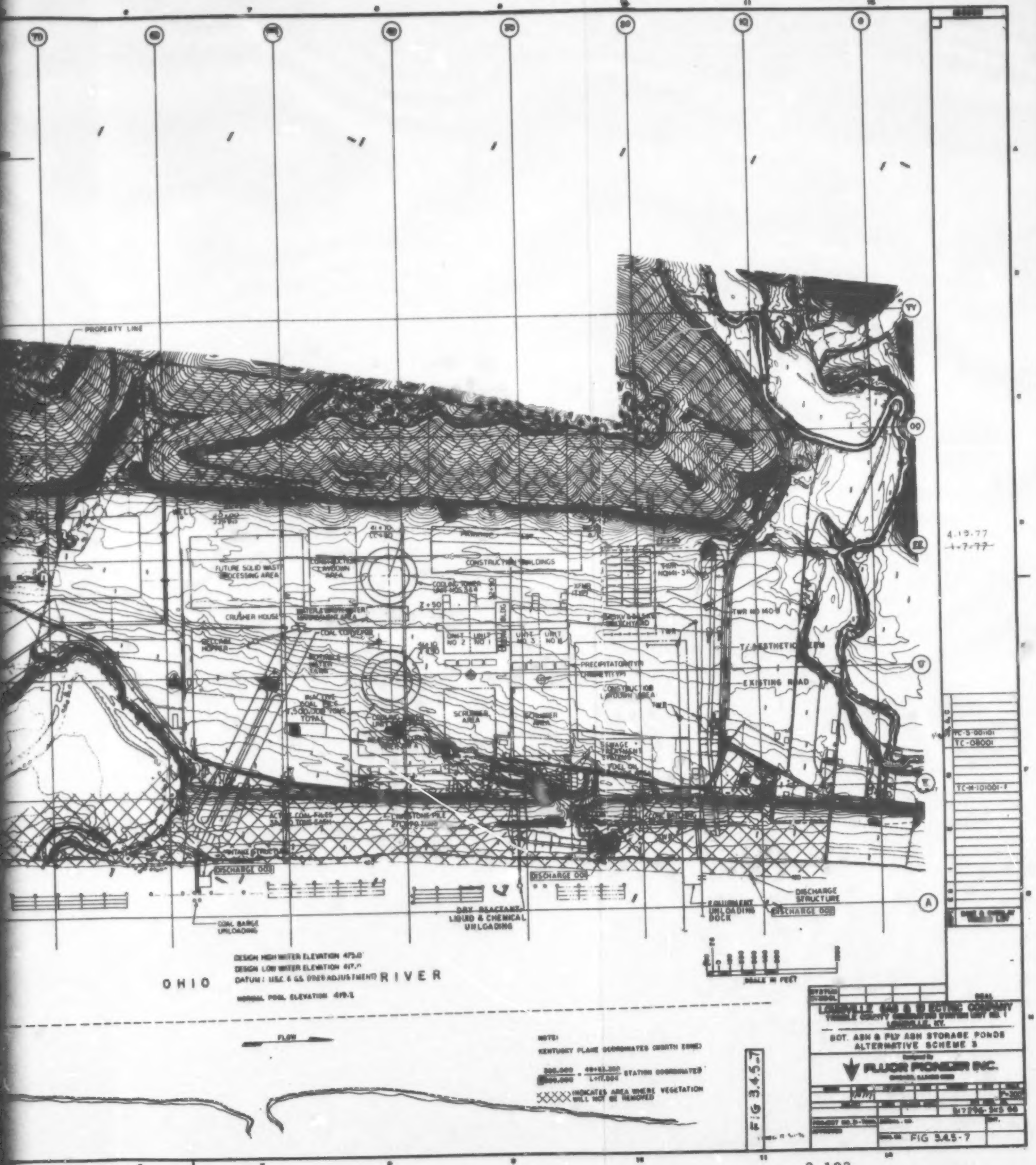
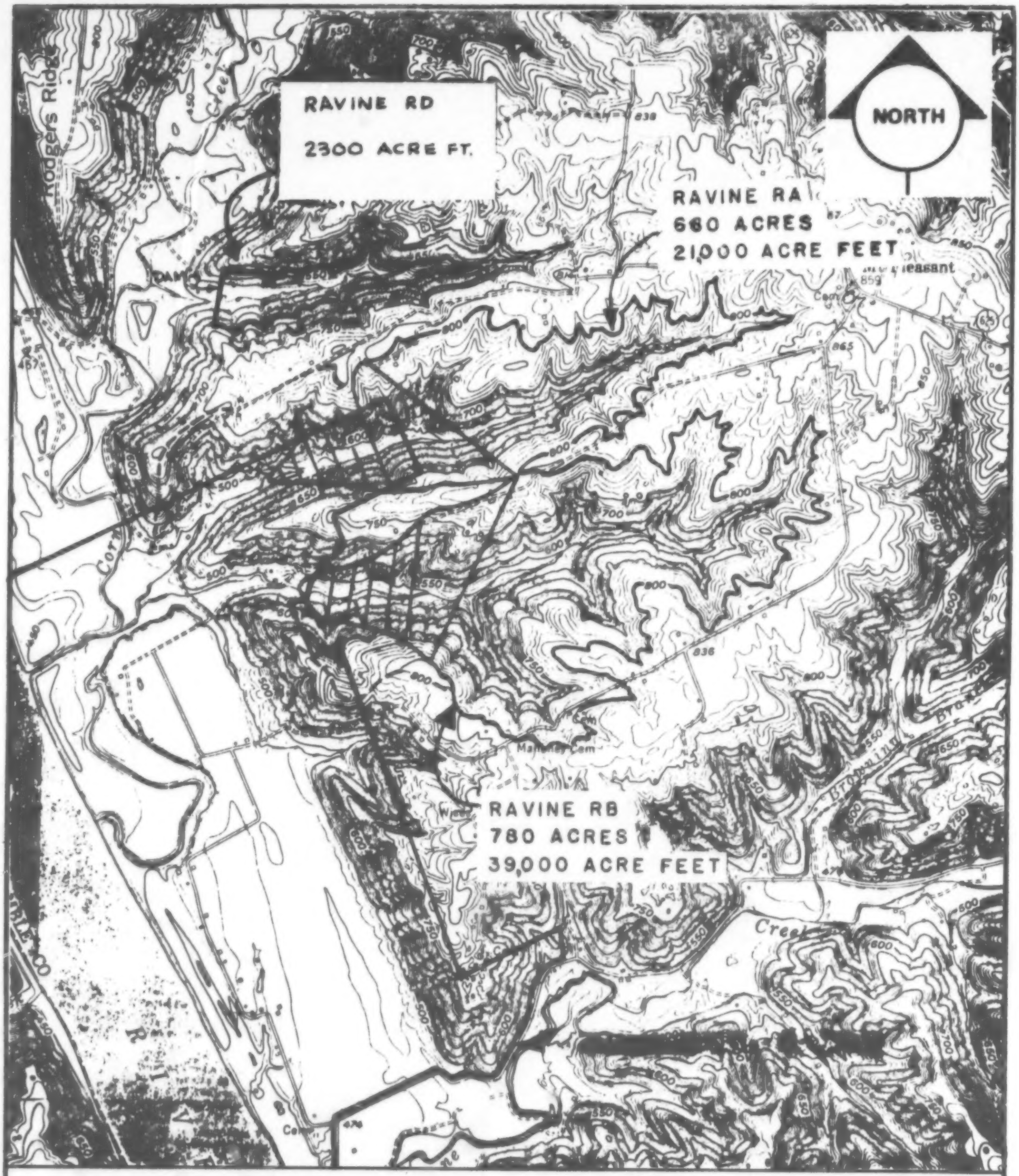

PROPERTY LINE
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION LAYDOWN AREA
COOLING TOWER UNIT NOS. 3 & 4
CONSTRUCTION BUILDINGS
PARKING
CRUSHER HOUSE
COAL CONVEYOR
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO 4
PRECIPITATOR (TYP)
CHIMNEY (TYP)
SWITCHYARD
XFMR (TYP)
TWR NO M-5
T/AESTHETIC BERM
EXISTING ROAD
CONSTRUCTION LAYDOWN AREA
INACTIVE COAL PILES 1,500,000 TONS TOTAL
SCRUBBER AREA
SCRUBBER AREA
SEWAGE TREATMENT SYSTEMS
FUEL OIL
ACTIVE COAL PILES
LIMESTONE PILE
INTAKE STRUCTURE
DISCHARGE 003
DISCHARGE 001
DISCHARGE 002
DISCHARGE STRUCTURE
COAL BARGE UNLOADING
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
OHIO RIVER
DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS (1929 ADJUSTMENT)
NORMAL POOL ELEVATION 419.1
FLOW
SCALE IN FEET
NOTE:
KENTUCKY PLANE COORDINATES (NORTH ZONE)
STATION COORDINATES
INDICATES AREA WHERE VEGETATION WILL NOT BE REMOVED
TC-S-00101
TC-08001
TC-M-10100I-F
4.19.77
~~4.7.77~~
LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.
BOT. ASH & FLY ASH STORAGE PONDS
ALTERNATIVE SCHEME 3
FLUOR PIONEER INC.
FIG 3.4.5-7

FIG 3.4.5-7

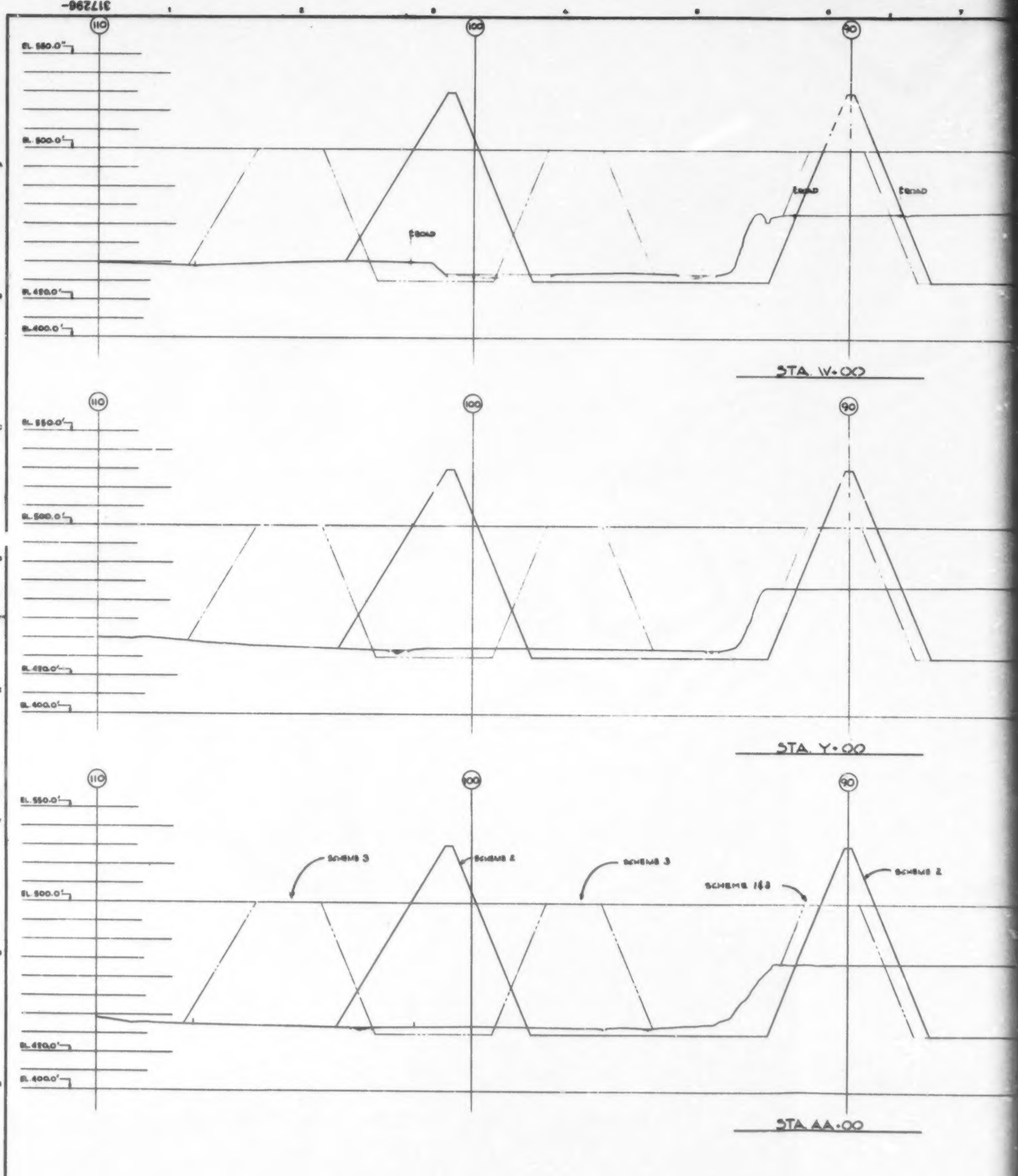

RAVINE RD
2300 ACRE FT.
RAVINE RA
660 ACRES
21,000 ACRE FEET
NORTH
RAVINE RB
780 ACRES
39,000 ACRE FEET
Rodgers Ridge
Corn
Creek
Browning
Majors Cem
Pleasant

Designed By
FLUOR PIONEER INC.
CHICAGO, ILLINOIS 60606

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY PLANT SITE
EMERGENCY FLY ASH & SLUDGE POND
ALTERNATIVE SCHEME 4

DRAWN		CHECKED		DE		APPROVED	SCALE-1"=2000'
A.P.	1/4/77			A P	1/4/77		PROJECT NO. 317296
A	B	C		D		E F	FIGURE 3.4.5-8

317296-


110
100
90
EL. 550.0'
EL. 500.0'
EL. 450.0'
EL. 400.0'
℄ ROAD
℄ ROAD
℄ ROAD
STA. W+00
110
100
90
EL. 550.0'
EL. 500.0'
EL. 450.0'
EL. 400.0'
STA. Y+00
110
100
90
EL. 550.0'
SCHEME 3
SCHEME 2
SCHEME 3
SCHEME 1&3
SCHEME 2
EL. 500.0'
EL. 450.0'
EL. 400.0'
STA. AA+00
1
2
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A
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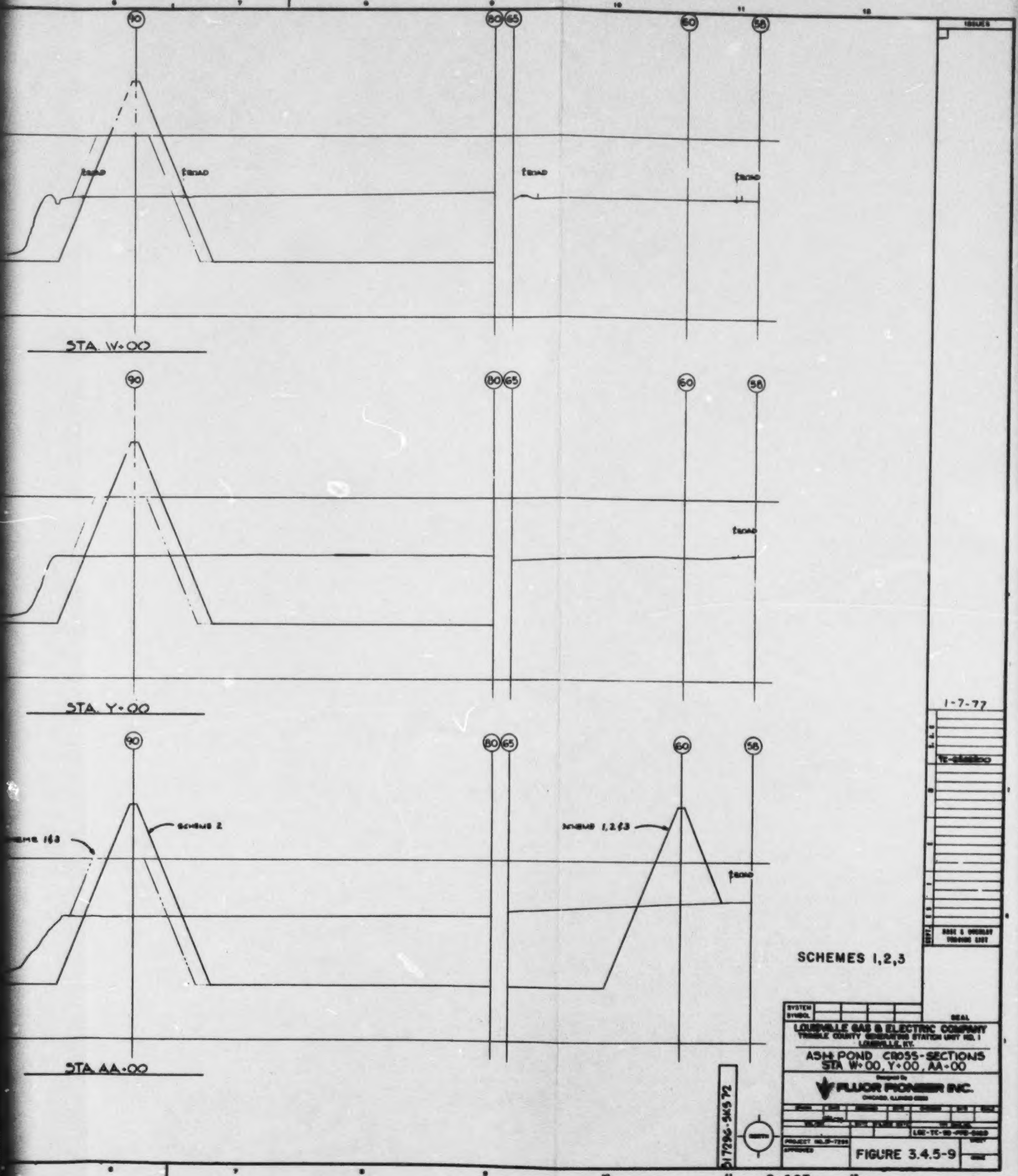

90
80
65
60
58
℄ ROAD
STA. W+00
STA. Y+00
heme 1&3
SCHEME 2
SCHEME 1,2&3
STA. AA+00
517296-SK572
NORTH

1-7-77

TC-[illegible]

BASE & OVERLAY TRACING LIST

SCHEMES 1,2,3

SYSTEM SYMBOL

SEAL

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.

ASH POND CROSS-SECTIONS
STA W+00, Y+00, AA+00

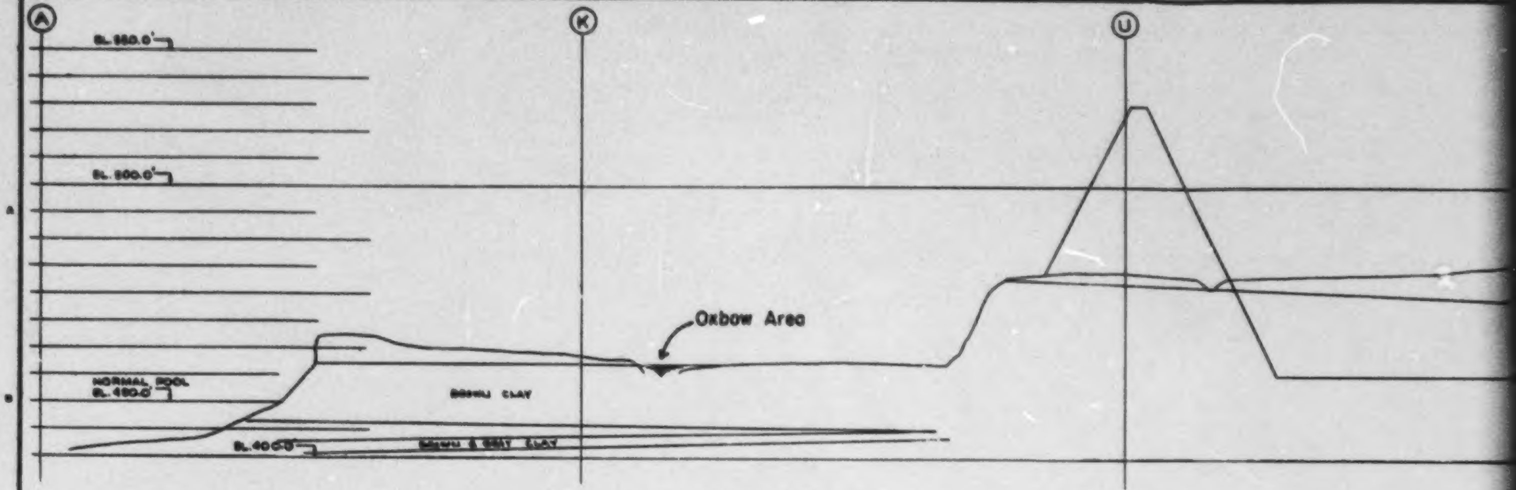
Designed By
FLUOR PIONEER INC.
CHICAGO, ILLINOIS

LGE-TC-[illegible]

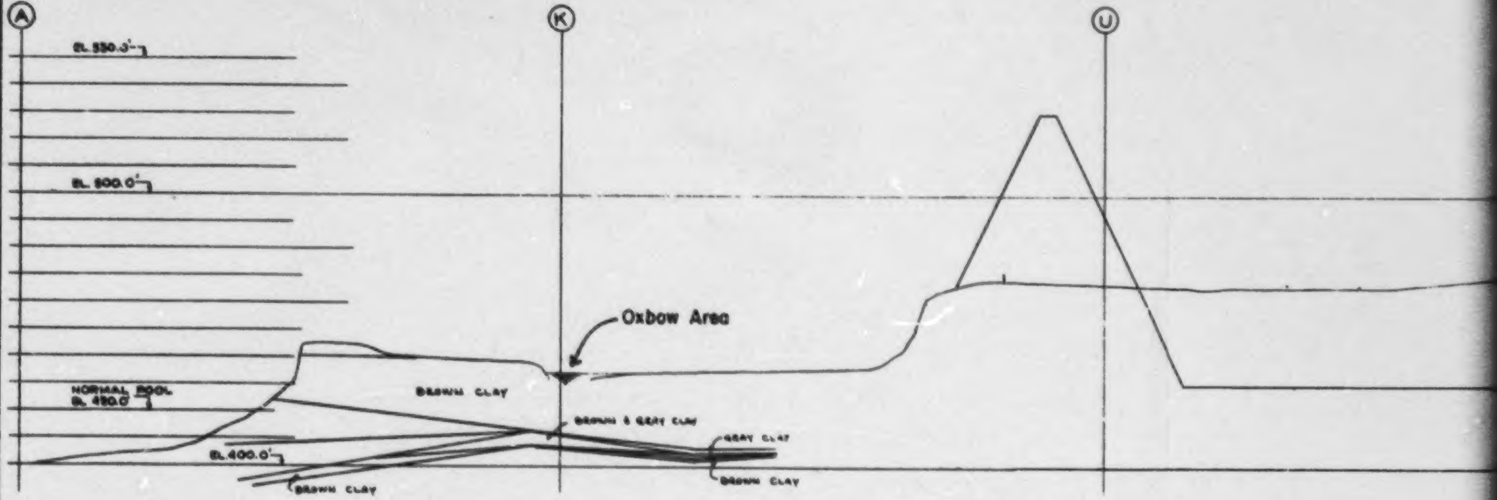
PROJECT NO.[illegible]

APPROVED

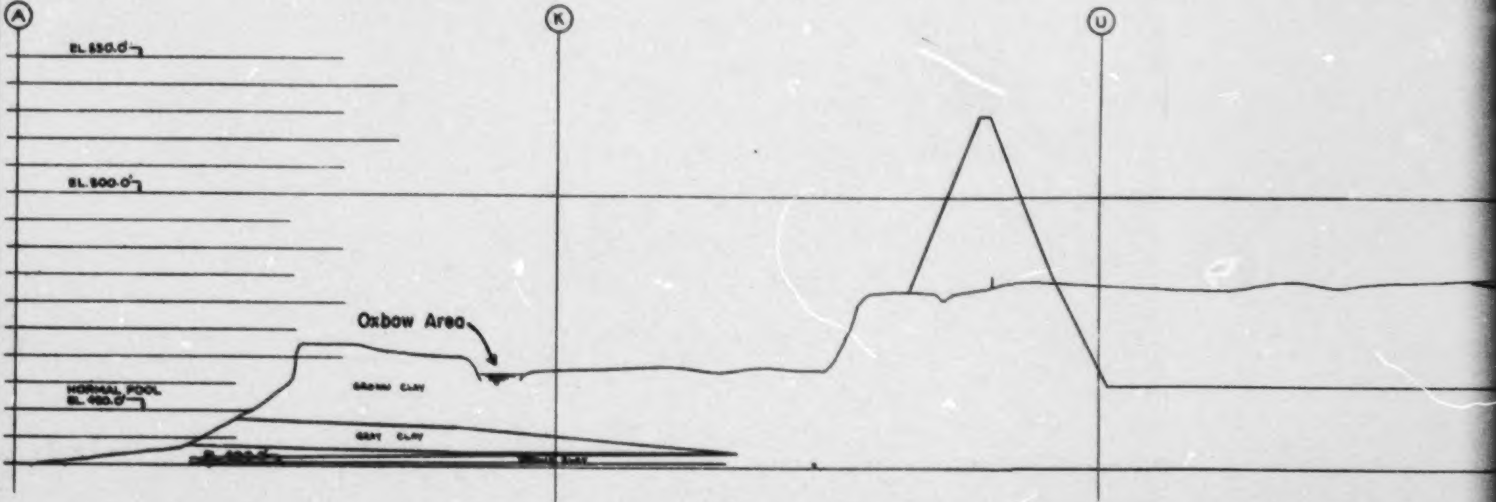
FIGURE 3.4.5-9


A
K
U
EL. 550.0'
EL. 500.0'
Oxbow Area
NORMAL POOL
EL. 420.0'
BROWN CLAY
EL. 400.0'
BROWN & GRAY CLAY

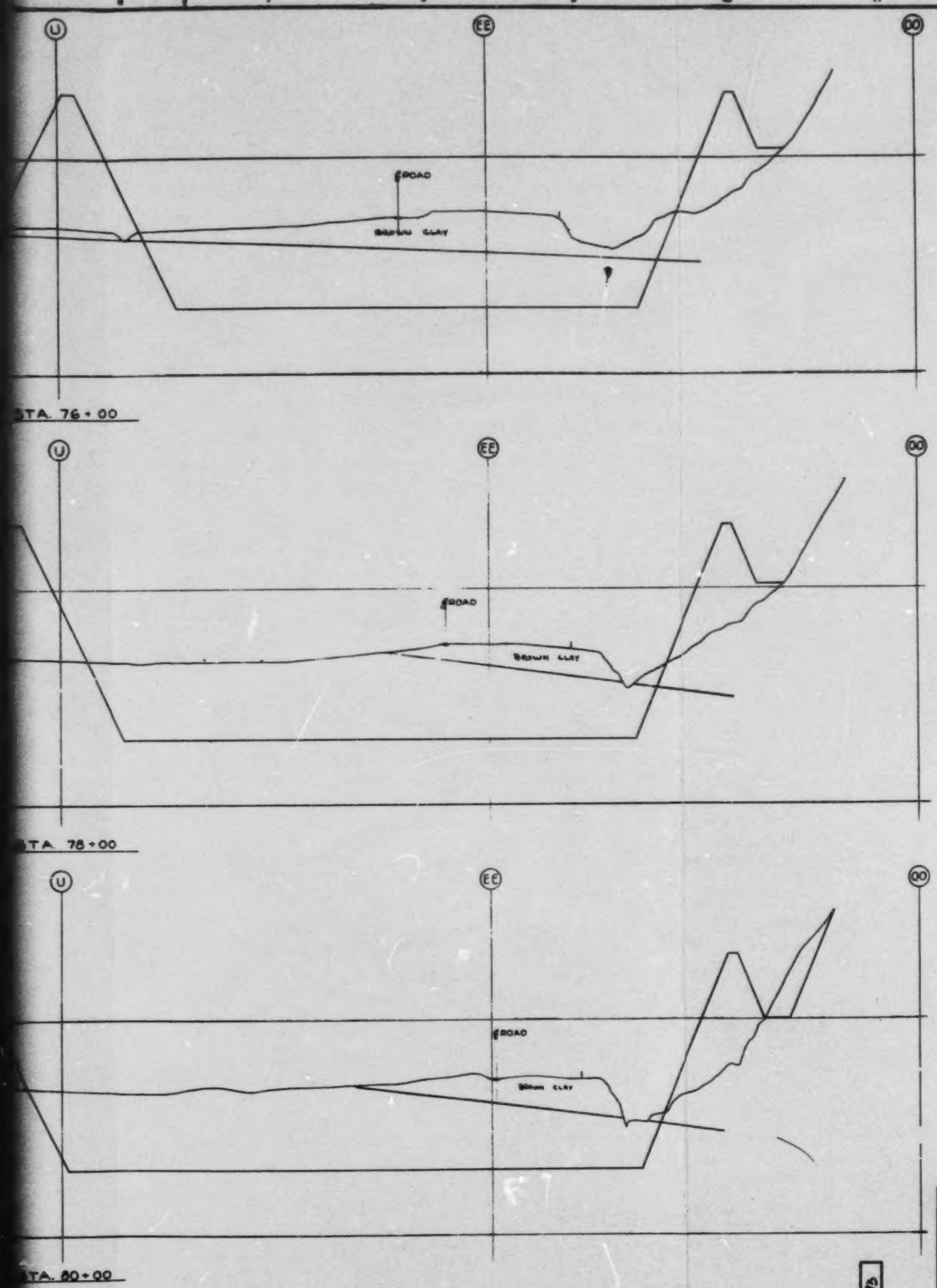
STA. 76+00


A
K
U
EL. 550.0'
EL. 500.0'
Oxbow Area
NORMAL POOL
EL. 420.0'
BROWN CLAY
BROWN & GRAY CLAY
GRAY CLAY
EL. 400.0'
BROWN CLAY
BROWN CLAY

STA. 78+00


A
K
U
EL. 550.0'
EL. 500.0'
Oxbow Area
NORMAL POOL
EL. 420.0'
BROWN CLAY
GRAY CLAY
EL. 400.0'
BROWN CLAY

STA. 80+00


U
EE
OO
℄ ROAD
BROWN CLAY
STA. 76+00
U
EE
OO
℄ ROAD
BROWN CLAY
STA. 78+00
U
EE
OO
℄ ROAD
BROWN CLAY
STA. 80+00

1-7-77

BASE & OVERLAY TRACING LIST

SCHEMES 1,2,3

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.

ASH POND CROSS-SECTIONS
STA. 76+00, 78+00 & 80+00

Designed by
FLUOR PIONEER INC.
CHICAGO, ILLINOIS

FIGURE 3.4.5-10

TABLE 3.4.5-1

DESCRIPTION OF DISPOSAL POND ARRANGEMENTS, TRIMBLE COUNTY GENERATING PLANT
(Total Expected 30-Year Production of Bottom Ash = 7,200 Acre-Feet;
1-Year Expected Production of Fly Ash/Scrubber Sludge with All Four Units = 5,140 Acre-Feet)

Arrangement	Shown on Figure	Description
Original Scheme	3.4.5-2, 3.4.5-3, and 3.4.5-4	Bottom ash, emergency fly ash, and scrubber sludge pond to be located in northern half of bottomland portion of site. Corn Creek to be relocated. Construction in wetlands. Storage capacity: bottom ash compartment = 7,200 acre-feet (30 years of storage provided) emergency compartment = 4,200 acre-feet (11 months of storage provided)
Scheme 1	3.4.5-5, 3.4.5-9, and 3.4.5-10	Bottom ash pond to be located in northern portion of site bottomland. Emergency fly ash and scrubber sludge pond to be located in small ravine near center, upland portion of site. Storage capacity: bottom ash pond = 7,120 acre-feet (approximately 30 years of storage provided) emergency pond = 2,300 acre-feet (approximately 5 months of storage provided)
Scheme 2	3.4.5-6, 3.4.5-9, and 3.4.5-10	Bottom ash compartment of disposal pond to be located similar to Scheme 1 arrangement. Emergency fly ash and scrubber sludge compartment to be located on northern end of disposal pond. Corn Creek to be relocated. Storage capacity: bottom ash compartment = 7,120 acre-feet (approximately 30 years of storage provided) emergency compartment = 2,074 acre-feet (approximately 5 months of storage provided)
Scheme 3	3.4.5-7, 3.4.5-9, and 3.4.5-10	Bottom ash pond to be located similar to Scheme 1 arrangement. Emergency fly ash and scrubber sludge pond to be located north of present Corn Creek. Portion of Corn Creek near northeastern corner of site to be modified. Storage capacity: bottom ash pond = 7,120 acre-feet (approximately 30 years of storage provided) emergency pond = 800 acre-feet (approximately 2 months of storage provided)
Scheme 4	3.4.5-8	Bottom ash pond to be located similar to Scheme 1 arrangement. Emergency fly ash and scrubber sludge pond to be located in a ravine north of the plant property. Storage capacity: approximately the same as Scheme 1

TABLE 3.4.5-2

RESULTS OF ENGINEERING AND ENVIRONMENTAL EVALUATION
OF DISPOSAL POND ARRANGEMENTS

Arrangement	Cost	ENGINEERING		ENVIRONMENTAL	
		Advantages	Disadvantages	Advantages	Disadvantages
Original Scheme	$13,339,503	•Adequate storage capacity			•A total of 286 acres of vegetation, including 60 acres of diverse bottomland hardwood-vegetation, is lost. An important wetlands area is irtrievably lost •An established stop-over point for migrating waterfowl is permanently lost •Population levels of species using area, including opossums, muskrats, raccoons, foxes, deer, and many species of birds, amphibians, and reptiles will be reduced
Scheme 1	$19,450,693	•Flooding of emergency pond during period of nonuse not required	•Inadequate capacity in emergency pond •Most expensive alternative •High dam required at mouth of ravine •Difficult to provide ravine with impervious lining to prevent ground water contamination •Extensive piping required to transport material to emergency pond in ravine •Roads and ditches required on perimeter of emergency pond •Gravel underdrain required in emergency pond	•Only 4 acres of bottomland woods are lost •Vegetation habitat similar to that which will be lost to disposal pond construction is present in adjacent areas •Present Corn Creek habitat not destroyed	•Total of 189 acres of vegetation is lost. An additional 22 acres of upland woods vegetation and habitat is lost •Populations of doves, quails, rabbits, squirrels, foxes and other furbearers, and deer will be reduced •Loss of flooding, adjacent agricultural fields, the increased human noise and disturbances, and the presence of physical structures could decrease the use of the oxbow and Corn Creek by waterfowl, raccoons and other animals •Oxbow area and Corn Creek may be degraded as a result of erosion and air pollution
Scheme 2	$13,591,003		•Inadequate capacity in emergency pond	•Oxbow area is preserved	•A portion (13 acres) of riparian vegetation along Corn Creek is lost •Wetland vegetation may be lost as a result of possible change in drainage and moisture regime after Corn Creek is relocated

TABLE 3.4.5-2 (Continued)

		ENGINEERING		ENVIRONMENTAL	
Arrangement	Cost	Advantages	Disadvantages	Advantages	Disadvantages
					°Total of 180 acres of vegetation is lost °Heavily used riparian wildlife habitat type is lost °Populations of waterfowl, doves, quails, furbearers, rabbits, squirrels, and deer will be reduced °Access to oxbow area for wildlife inhabiting fields, hills, and ravines to east and northeast of site is reduced °The loss of flooding and adjacent agricultural fields, the increased human noise and disturbance, and the presence of physical structures could also decrease the use of the oxbow area by waterfowl, raccoons, and other animals °Oxbow area may be degraded as a result of erosion from construction; oxbow vegetation may suffer from air pollution as a result of plant operation °Aquatic habitat provided by Corn Creek is lost (long-term)
Scheme 3	$12,657,174		°Inadequate capacity in emergency pond	°Oxbow area is preserved °Only 8 acres of riparian hardwood vegetation are lost °Somewhat better wildlife access to oxbow area is maintained °Partial alteration of Corn Creek would mean a smaller amount of aquatic habitat would be lost (long-term); lower portion of creek would suffer reduced productivity during alteration of upper portion, but would recover within a shorter period of time than if that portion were rechannelized	°Total of 177 acres of vegetation is lost °Potential (small) change in wetlands could occur as a result of change in water regime °Populations of waterfowl, doves, quails, furbearers, rabbits, squirrels, and deer will be reduced °Loss of adjacent agricultural fields; the increased human noise and disturbances and the presence of physical structures could decrease the use of the oxbow area by waterfowl, raccoons, and other animals

TABLE 3.4.5-2 (Continued)

Arrangement	Cost	ENGINEERING Advantages	ENGINEERING Disadvantages	ENVIRONMENTAL Advantages	ENVIRONMENTAL Disadvantages
					°Productive aquatic habitat will be lost during rerouting of upper portion of Corn Creek °Oxbow area may be degraded as a result of erosion from construction; vegetation of both the oxbow and Corn Creek could suffer from air pollution from plant operation
Scheme 4	Approximately same as Scheme 1	Same as Scheme 1	Same as Scheme 1	°Wetland is preserved °Only 4 acres of bottomland woods are lost	°Total of 208 acres of vegetation is lost: 81 acres in Ravine RD for emergency storage and 127 acres for bottom ash pond. °An additional 81 acres of upland woods habitat is lost °Project-related activities are spread out over larger area, with resulting increase in potential for disruption of wildlife and humans in the area °Oxbow area may be degraded as a result of erosion from construction; vegetation of both the oxbow and Corn Creek could suffer from air pollution from plant operation

TABLE 3.4.5-3

BREAKDOWN OF COSTS[a] FOR DISPOSAL POND ARRANGEMENTS

	Original Scheme			Scheme 1[b]			Scheme 2			Scheme 3		
Cost Item	Amount of Material	Cost per Unit	Total Cost	Amount of Material	Cost per Unit	Total Cost	Amount of Material	Cost per Unit	Total Cost	Amount of Material	Cost per Unit	Total Cost
Bottom Ash Pond												
Cleaning and Grubbing	230 acres[c]	$2,500	$ 575,000	105 acres	$2,500	$ 262,500	145 acres[c]	$2,500	$ 362,500	155 acres[c]	$2,500	$ 387,500
Cut[d]	6,141,800[e]	$0.75	$ 4,606,350	4,852,240	$0.75	$ 3,639,180	5,457.503[e]	$0.75	$ 4,093,127	5,093,517[e]	$0.75	$ 3,820.137
Fill[f]	4,205,388	$1.25	$ 5,256,735	2,792,541	$1.25	$ 3,490,676	5,754,553	$1.25	$ 7,193,191	5,386.430	$1.25	$ 6,733,037
Stockpiled Clay[g]	1,160,567	$2.50	$ 2,901,418	550,462	$2.50	$ 1,376,155	776,874	$2.50	$ 1,942,185	686,592	$2.50	$ 1,716,480
TOTAL			$13,339,503			$ 8,768,511			$13,591,003			$12,657,174
Emergency Pond												
Cleaning and Grubbing				49 acres	$4,000	$ 196,000						
Fill[h]				1,661,273	$2.50	$ 4,153,182						
Stockpiled Clay[g]				249,000	$10.00	$ 2,490,000						
Gravel Under-Drain				249,000	$15.00	$ 3,735,000						
Ditches				5,500 linear feet	$6.00	$ 33,000						
Roads				2,500 linear feet	$30.00	$ 75,000						
TOTAL						$10,682,182						
GRAND TOTAL			$13,339,503			$19,450,693			$13,591,003			$12,657,174

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[a] In terms of cubic yards of material required, unless otherwise indicated.

[b] Costs for Scheme 4 are approximately the same as for Scheme 1.

[c] Bottom ash pond units and costs are for bottom ash and fly ash/sludge ponds combined.

[d] Includes portion of clay to stockpile.

[e] Includes excavation for relocated Corn Creek.

[f] Excludes clay from stockpile.

[g] Removed from stockpile and placed.

[h] From bottom ash pond.

Following a review of the alternative arrangements, the EPA advised the Applicant that the originally proposed onsite disposal pond scheme was not an acceptable design from an environmental standpoint, and that one of the alternative designs needed to be chosen before the onsite disposal pond scheme in the Draft EIS would represent a design acceptable to the EPA. By mutual agreement between the Applicant and the EPA, Scheme 2 (depicted on Figure 3.4.5-6), which preserves the oxbow area, was chosen as the proposed onsite disposal pond scheme. This scheme is believed by the Applicant to be the only alternative that contains storage capacity sufficient to allow successful operation of the power plant. (Besides being the most expensive alternative, Scheme 1, which would provide a similar amount of storage capacity, may be infeasible from a design standpoint because of the difficulty of providing the additional storage ravine with an impervious lining and the high dam required at the mouth of the ravine.) The originally proposed scheme (depicted on Figure 3.4.5-2), however, remains the Applicant's preferred design.

Alternative Solid Waste Handling Approaches

Initially, two basic solid waste handling approaches were considered and are discussed in the following paragraphs.

1. Approach A

   a. Bottom ash would be conveyed by means of a jet pump as a slurry from the bottom ash hopper to a compartment of a disposal pond. The conveying water would be cycled back for system reuse

   b. Fly ash would be conveyed pneumatically from the precipitator hoppers by means of a water-powered venturi. The ash-water-air mixture would pass from the venturi into an air separator. From this, the ash/water slurry would be sluiced to the same pond compartment as the bottom ash. At maximum, the slurry would be 10 percent ash by weight

   c. Scrubber waste solids would be pumped off the bottom of the scrubber clarifier as a slurry (12 percent solids by weight) to a separate compartment of the disposal pond. Any decant or overflow from this compartment would be recirculated to the scrubber process

2. Approach B

   a. Bottom ash would be treated as in Approach A

   b. Fly ash would be conveyed pneumatically from the precipitator hoppers to a hold-up silo with a capacity for 3 days' peak production. The fly ash would then be conveyed by a pressure system to a wetting system where a sludge (50 percent solids by weight) would be produced. The sludge would then be sluiced to its final disposal location

c. Scrubber waste solids would be passed as a slurry from the clarifier to the thickener. The thickener would concentrate the slurry to a sludge (20 percent solids by weight). The sludge would then be pumped to a hold-up pond capable of holding sludge from 3 days' peak production. From the hold-up pond, the sludge would be pumped to the final disposal site

These two initial approaches were unsatisfactory, however, for the following reasons. Both require disposal capacities greater than those available. In addition, Approach A was unsatisfactory because of significant water treatment problems. It is not possible to have all the fly ash fall out of suspension even in absolutely still water. Because of the ash carry-over in the recycled water, the water would require treatment with flocculants and then clarification. Given the volume of water requiring treatment, the expense would be prohibitive. If the fly ash in suspension were allowed to carry over into the conveying systems, a large penalty in pump repair and maintenance would occur.

Both approaches handle the scrubber solids with high water content. This high water content caused very large disposal volume requirements, since the solids would be in suspension and well dispersed throughout the liquid. In a pond, very little decant effect would occur.

For these reasons, an additional approach--Approach C--was developed.

3. Approach C

a. Bottom ash would be handled as in both A and B.

b. Fly ash would be handled through the fly ash silo as in Approach B. From the silo, the fly ash would be conveyed by a pneumatic pressure system to the fly ash transfer bin of a process plant located near Ravines RA and RB. From the bin, the fly ash would be conveyed dry to a pug mill for mixing with the scrubber solids after they had been vacuum filtered. The resulting mixture would be conveyed mechanically to the ravines

c. Scrubber waste solids would be handled as in Approach B through the hold-up pond stage. From the hold-up pond, the sludge would be pumped to a transfer tank in the process plant. From the transfer tank, the sludge would be fed into vacuum filters. The resulting filter cake would be transferred to the pug mill for mixing with the dry fly ash

d. Emergency disposal would be provided in a compartment of the onsite disposal pond. The volume of this compartment would equal approximately 1 year of normal production (all four units operating). The sludge would be pumped directly to the compartment from the hold-up pond. The fly ash would be wetted (as in Approach B) before deposition in the compartment

In Approach C, the assumption was made that the dry fly ash and scrubber filter cake will form a cement-like mixture that is relatively nonleachable. This assumption is based on the reports of operators with scrubber systems that clean both fly ash and SO_2 from the flue gas, and those with systems that mix fly ash and scrubber sludge separately.

4. Approach D

Alternative D was developed at a later stage in the design of the solid waste handling system. It consists of combining the ash and scrubber sludge with a chemical fixation agent to produce a stable, nonleachable material suitable for landfill, which would be disposed of in the nearsite disposal area, Ravines RA and RB. An onsite emergency disposal pond would also be constructed.

The following is an outline of the chemical fixation alternative process and disposal scheme.

a. Bottom ash would be conveyed hydraulically to the onsite bottom ash pond

b. Fly ash would be conveyed pneumatically in a dry state to the process plant

c. Scrubber sludge from clarifier or thickener tank underflow would be pumped to the process plant

d. A chemical fixation agent would be conveyed in a dry state to the process plant

e. Fly ash, scrubber sludge, and chemical fixation agent would be mixed at the process plant and subsequently transferred mechanically to Ravine RA or RB, where the chemical fixation process would complete itself

f. Fixed material would be dumped, distributed, and compacted as required to form terraces in the sloping ravines

In the event that the process plant should be unavailable for use, solid wastes would be disposed of in an emergency hold-up pond in the manner briefly described in the following outline.

a. A scrubber sludge/fly ash compartment with a storage capacity equal to approximately 1 year's solid waste production by the plant (all four units) would be part of the onsite disposal pond

b. Sludge underflow from the clarifier or thickener would be diverted directly to the emergency hold-up pond

c. Bottom ash would be diverted directly to the pond for storage in one of its compartments. Water from this compartment would be decanted and recycled to the plant's process water system

d. Fly ash would be conveyed by a pressure system from storage silos to a wetting station where water would be added to achieve approximately 50 percent solids by weight. This mixture would then be transferred to the emergency hold-up pond

The cumulative quantities of solid waste expected to be produced by the plant are presented in Technical Appendix IV. Estimated total solid waste production, total chemical fixation agent required, and total fixed solid wastes to be disposed of are presented in Table 3.4.5-4.

The emergency hold-up pond would be developed as follows: the bottom and interior faces of the dike would be lined with a layer of impervious clay. Until sufficient waste is deposited above the clay liner, there would be provision for flooding the pond during periods of high water to prevent instability of the pond bottom. After plant retirement, or earlier if necessary, the contents of the emergency scrubber sludge-fly ash compartment could be reslurried and transferred to the process plant for fixation and ultimate disposal. The entire onsite area would then be reclaimable.

Other Alternatives

An alternative to the Applicant's development and operation of its own chemical fixation process is the use of a commercial process. Chemical fixation of scrubber sludge and related materials is currently being marketed by several commercial groups, including Dravo Corporation, IU Conversion Systems, Chemfix Corporation, and Factory Mutual Research Corporation.

1. Dravo Corporation--Dravo offers what is called the "Synearth" system. This system processes fly ash and scrubber sludge with a proprietary chemical called Calcilox. The processed material must sit in a settling pond for 7 to 10 days, with decant water recycled to the plant. The resultant product is claimed to be a sanitary landfill material with reasonable soil bearing capacity

2. IU Conversion Systems, Inc. (IU)--IU also offers a system--called the "Poz-O-Tec" process--using a proprietary chemical; the system will handle dry fly ash, dewatered bottom ash, and dewatered sludge. Again, the resultant product is claimed to be a sanitary landfill material with reasonable soil bearing capacity

TABLE 3.4.5-4
CHEMICALLY FIXED SOLID WASTE QUANTITIES

	Short Tons/Year		Total Short Tons Produced	
	Years 1-20[a]	Years 21-30[b]	Years 1-20[a]	Years 21-30[b]
	495 MWe Unit			
Limestone Reactant Wastes				
Limestone sludge (wet) + ash (wet)	75.7×10^4	31.5×10^4	$1{,}514 \times 10^4$	$1{,}829 \times 10^4$
Chemical fixation agent, dry	7.60×10^4	3.16×10^4	152×10^4	184×10^4
Water treatment solids, wet	0.28×10^4	0.11×10^4	5.6×10^4	6.7×10^4
Total	83.6×10^4	34.8×10^4	$1{,}672 \times 10^4$	$2{,}019 \times 10^4$
	695 MWe Unit			
Limestone Reactant Wastes				
Limestone sludge (wet) + ash (wet)	103×10^4	43.2×10^4	$2{,}068 \times 10^4$	$2{,}500 \times 10^4$
Chemical fixation agent, dry	10.4×10^4	4.33×10^4	208×10^4	251×10^4
Water treatment solids, wet	0.36×10^4	0.14×10^4	7.2×10^4	8.6×10^4
Total	114×10^4	47.7×10^4	$2{,}282 \times 10^4$	$2{,}760 \times 10^4$

---

[a] Average capacity factor = 60 percent.

[b] Average capacity factor = 25 percent.

3. Chemfix Division of Environmental Sciences, Inc. (Chemfix)--Chemfix markets a proprietary fixation process for conversion of various industrial sludges to stable landfill with at least two inorganic chemicals--one liquid and one powder. The volume of additive needed is 10 percent or less of the volume of waste. At present, Chemfix has not contracted with utilities for full-scale scrubber sludge disposal, although its process is being tested on a smaller scale at TVA's Shawnee plant in Paducah, Kentucky

4. Factory Mutual Research Corporation (FMRC)--FMRC has a method of sludge fixation employing the addition of a polymer structure to the sludge. The polymer essentially acts as a mechanical structure to thicken the sludge. The chemical reaction is begun when borax is added and causes a reaction within the polymer itself, which filters out suspended particles as it shrinks. The rubbery material produced drains to about 50 percent solids and can be compressed to 75 to 80 percent solids. When added to water, the compressed material will fragment with time but will not reslurry

For both Dravo and IU, the following schemes of operation are available:

1. Utility owns and operates vendor-designed plant with agreement to purchase proprietary chemical
2. Vendor owns, but utility operates
3. Vendor owns and operates

Chemfix and FMRC represent relatively unproven prototype designs.

Recently, a new development was announced by Dravo and advertised by Koch. This is a process using flue gas waste heat and, if necessary, additional heat from fuel or steam to evaporate the water from the scrubber solid waste slurry to produce a dry scrubber solid waste.

By using such a process and pneumatic conveying, it might be possible to further minimize ultimate disposal volume requirements and the water content of the solid wastes.

However, the above named alternative methods of solid waste disposal have the following disadvantages:

1. The Applicant becomes captive through dependency on the particular contractor
2. No reliability history has been established for these systems

3. There is no established market for the product to guarantee that operating and handling costs associated with these systems would be reduced. If future markets for the products eventually developed, then these contractors certainly could enter into agreements with the Applicant. These agreements would be similar to those presently existing between certain utilities and fly ash brokers, in which the broker takes all or part of the ash

Several other alternative solid waste disposal methods were considered by the Applicant. Because these were not as attractive and/or as feasible as those previously discussed, they are presented in Appendix G.

3.4.6 Alternative Transmission Systems

Three alternative transmission systems were evaluated for the proposed facility: 138-kV overhead transmission lines, 345-kV overhead transmission lines, and underground oil-filled, pipe-type cables.

318-kV Versus 345-kV Overhead Transmission lines

To carry the power generated by the four-unit proposed generating plant, a total of eight 138-kV transmission lines would be required. This compares to a total requirement of only three 345-kV lines. Compared to the three 345-kV lines, the 138-kV lines would result in the following:

1. Increased visual impact
2. Greater use of natural resources in the construction of the lines, including increased right-of-way requirements
3. Increased nuisance to area residents during construction
4. Increased costs to operate lines due to the lower efficiencies of the 138-kV lines

Underground Oil-Filled, Pipe-Type Cable

An alternative to overhead transmission lines would be underground oil-filled, pipe-type cable, with either a pressurized or a circulating system.

With the pressurized system, oil is maintained at high pressure to thoroughly saturate the paper insulation of each conductor. This provides the proper dielectric to maintain insulation integrity.

The circulating oil system is designed for cooling capability and is recommended for relatively short lines. The oil is constantly recycled by means of above-ground cooling facilities. This system is not practical for larger transmission lines. For both of the underground oil-filled, pipe-type cable systems, limitations on lengths of cable that can be handled and shipped necessitate line splicing, which is often a problem.

With underground cables, as line length increases, additional pumping facilities are required. An economic comparison indicates that installation of either of the pipe-type systems would cost more than 12 times the installed cost of an equivalent-rated overhead transmission line with lattice-type structures.

3.4.7 Alternative Plant Systems Comparison

The Trimble County Generating Plant project has not yet reached the final design stage, although the various systems and their major components have been identified. Section 3.4 described the various alternative components of the plant systems that have been studied by the Applicant. Tables 3.4.7-1 through 3.4.7-5 summarize the engineering, economic, and environmental advantages and disadvantages of these alternative components (with the exception of the solid waste disposal schemes, which were compared in Section 3.4.5). Table 3.4.7-6 lists those components preliminarily selected by the Applicant to constitute, for purposes of impact analysis, the preferred (proposed) plant systems. However, in no case will the Applicant choose an alternative that results in a greater (more significant) environmental impact than that associated with the preferred (proposed) systems and components identified in Table 3.4.7-2. A detailed description of the proposed plant is provided in Section 4.0.

TABLE 3.4.7-1

WASTE HEAT REJECTION SYSTEM

System	Advantages	Disadvantages
ONCE-THROUGH COOLING SYSTEM		Causes localized changes in temperature distribution of source of water. Relatively high ambient source water temperatures need to be lowered artificially. Federal regulations discourage once-through cooling systems.
CLOSED CYCLE SYSTEMS		
Man-Made Lakes	No effect on present aquatic habitat.	Requires between 2,340 and 11,700 acres; the site has only 1,000 acres (not including ravines).
Spray Ponds or Canals	Requires fewer acres than man-made lake, with same environmental advantage.	Tends to cause local fogging. Has not been used on large scale in areas that are geographically and meteorologically similar to the Trimble County site.
Dry Cooling Towers	Eliminates evaporative losses of cooling water. Requires fewer acres, compared to lakes or canals. No fogging or icing problems. Less damaging to aquatic habitat than once-through systems.	Turbine exhausts at high temperatures and high pressures; this is inefficient for cycle operation. Domestic turbine vendors restrict their turbine exhaust pressures to below those economically achievable with present dry tower design.
Mechanical Draft Towers		
Rectangular	Requires fewer acres than lakes or canals. Lower initial cost than round mechanical draft towers. Less damaging to aquatic habitat than once-through systems. Lower cost than natural draft towers.	Significant ground level fogging and icing. Requires more land than round mechanical draft towers. Has less desirable plume rise and dispersion characteristics than round mechanical draft towers.
Round	Better plume rise and dispersion characteristics than rectangular mechanical draft towers. Requires less land than rectangular mechanical draft towers.	Higher initial cost than rectangular mechanical draft towers.
Wet/Dry Mechanical Draft Towers	Helps minimize water consumption by limiting evaporation. Allows attainment of turbine back pressures acceptable to domestic turbine vendors.	Higher initial cost than round mechanical draft towers. More expensive to operate than round mechanical draft towers. Has not been used extensively.
Hyperbolic Natural Draft Tower	Disperses plume at a very great elevation compared to other tower types. Trapping of water droplets in air is minimized. Does not require more site area than other tower types, despite its overall size. Operating cost generally lower than other tower types.	Greatest visual impact. Higher initial cost than other tower types.

TABLE 3.4.7-2

ATMOSPHERIC POLLUTION CONTROL

System	Advantages	Disadvantages
O_2 CONTROL		
oal Beneficiation, (mechanical washing, magnetic separation, chemical separation)	Reduces amount of sludge produced by plant.	Mechanical washing depends on availability of sufficient water near mine. Magnetic and chemical separation still in laboratory testing stage. Most beneficiated coal would not allow emissions standards to be met without other control methods.
olvent Refined Coal	Low in ash and sulfur.	Still in development stage. Very expensive and not available in required quantities.
lue Gas Desulfurization (FGD)		
Wet lime or limestone scrubbing	Can remove up to 90% of sulfur from flue gases. Least expensive and most reliable of FGD processes now in operation.	Results in an insoluble waste product, calcium sulfite/calcium sulfate, which requires a large area for disposal. Potential ground water problems. Potential for some scaling or plugging of scrubber.
Double alkali scrubbing	Reduces scrubber scaling and plugging problems. Has been used successfully for industrial boilers. Has higher SO_2 removal efficiency than wet lime or limestone scrubbers.	Waste product contains sodium salts, with potential for water pollution. Loss of reactant (sodium salts) in waste makes the process more expensive than lime/limestone scrubbing. Has not been used in this country at a coal-fired generating plant larger than 20 MW.

System	Advantages	
Magnesium oxide scrubbing	Process produces small amounts of waste, recycles material used as reactant, and yields potentially marketable by-product. Suitable for areas with limited sludge disposal space and a potential market for the sulfur by-product. If cost can be defrayed by assumed sales revenue, may prove to be less expensive scrubbing method over life of plant.	Ere oth Mod ste Pre fir bas May the lar Pro tes lar
Catalytic oxidation	Process produces small amounts of waste, recycles material used as reactant, and yields potentially marketable by-product. If cost can be defrayed by assumed sales revenue, may prove to be less expensive scrubbing method over life of plant.	Dif tem Cor in Com adv the Cap hig scr Add ass aci Pro sta
Sodium scrubbing	Process produces small amounts of wastes, recycles material used as reactant, and yields potentially marketable by-product. If cost can be defrayed by assumed sales revenue, may prove to be less expensive scrubbing method over life of plant.	Lif cos lim

TABLE 3.4.7-2

SPHERIC POLLUTION CONTROL SYSTEMS

Advantages	Disadvantages
produces small of waste, recycles l used as reactant, lds potentially ble by-product.	Erosion, dust emissions, and other problems. More expensive than lime/limestone scrubbing.
le for areas with sludge disposal d a potential for the sulfur ct.	Presently more expensive on a first cost and operating cost basis than previous two methods. May involve problems in marketing the by-product because of the large quantities produced.
can be defrayed by sales revenue, may be less expensive g method over life t.	Process presently undergoing testing and modification on large-scale demonstration units.
produces small of waste, recycles l used as reactant, lds potentially ble by-product.	Difficulty in producing high temperatures for the dry process. Corrosion and cooler plugging in acid section of system.
can be defrayed by sales revenue, may be less expensive ing method over life t.	Contamination by fly ash may adversely affect the life of the catalyst. Capital and operating cost higher than for lime/limestone scrubbing. Additional marketing problems associated with weak sulfuric acid by-product. Process at demonstration plant stage.
produces small of wastes, recycles l used as reactant, lds potentially ble by-product.	Life-time operating and labor costs are higher than for lime/limestone scrubbing.
can be defrayed by sales revenue, may be less expensive g method over life t.	

System	Advantages	Disadvantages
	Presently undergoing full-scale testing at several coal-fired facilities.	
Particulate Control		
Electrostatic precipitator	Up to 99.6% removal of fly ash, reliable, low operating and maintenance costs.	
Wet scrubber - Venturi type		Excessive energy consumption, large volumes of water, produces waste sludge and associated disposal problems.
Fabric filter (bag house)		Larger space requirements, limited design temperatures, and higher maintenance costs.
Mechanical separators (cyclone)		Low operating efficiencies, necessitating the supplementary use of one of the other kinds of precipitators. Hence, higher capital and operating costs.
NO_x Control		
Water injection		High loss in thermal efficiency makes this method expensive in times of rising fuel costs and energy resource scarcity.
Flue gas recirculation	Easily adapted to coal-firing. Produces lowest NO_x levels. Easier to control than over-fire air.	Much higher capital cost.
Over-fire air	Like flue gas recirculation, has been used extensively to control steam temperature. NO_x is reduced with relatively little capital cost.	

TABLE 3.4.7-3

PLANT WATER USES

WATER SOURCES (Major Water Uses)[a]		
Deep Wells	Water is usually of better quality than river water and requires less pretreatment before use. No impact on aquatic life.	Major plant water requirements, even with maximum water reuse, are too great for this type of source.
Radial Wells	Can extract greater quantities of ground water than deep wells. Water quality better than for river water. No impact on aquatic life.	Water quality is not as high as with deep wells. Initial cost is extremely high. Quantity required for plant is uncertain for life of plant due to plugging problems.
River Water	Water quantity required can be met.	Impingement/entrainment of aquatic life.
WASTEWATER DISCHARGE		
Cold Side Cooling Tower Blowdown		
Discharge to disposal pond		Blowdown would quickly overflow any feasibly sized pond on site.
Discharge to river	Adequate receiving body.	More expensive discharge structure.
Site Runoff		
Routing runoff from retention basin to disposal pond		Requires a pond larger than area available can accommodate. Requires additional pumping and transport equipment.
Discharge from retention basin to river	Release of runoff is controlled and monitored to ensure quality is acceptable for discharge.	
Plant Process		
Discharge to disposal pond	No pollutants from plant processes allowed to enter environment.	

---

[a] Smaller water requirements will be supplied by deep wells.

TABLE 3.4.7-4

INTAKE AND DISCHARGE STRUCTURES

System	Advantages	Disadvantages
INTAKE STRUCTURE LOCATION		
Shoreline	Less pump discharge piping required.	Deep excavation required to provide low velocity through trash racks.
		More costly because of depth of required cut.
		Approach canal could trap and destroy fish.
Offshore	Can be located near cells supporting the coal barge unloader for protection from river traffic and debris.	Reduced river velocities, caused by mooring cells and unloading facilities, could result in increased siltation around intake structure.
	Minimum length of piping to the cooling towers.	
INTAKE STRUCTURE DESIGN		
Conventional	Proven reliability.	Impingement and entrainment of aquatic life.
		Bridge required for service personnel.
Perforated Pipe	Less complicated than conventional structure.	Depth of river at design low water may not be adequate.
	Lower construction and operating costs.	Large amount of siltation could cause heavy silt intake and clogging of the system. Regular back flushing with water or air and dredging of the area could be required.
	No impingement of fish.	
	Shorter bridge required because pump is located onshore.	
DISCHARGE CONDUIT AND STRUCTURE		
Direct Discharge	Less head loss; ability to discharge at higher flood levels than indirect discharge line.	Less thermal dispersion because of location of discharge port near unloading facilities.
Indirect Discharge	Discharge port away from riverfront facilities.	Greater head loss; more costly.
Open Channel Conduit	Less costly.	
Buried Conduit	No interference with surface operations, no visual impact, protection from external conditions, ability to carry various flow rates.	
Pumping	Ability to discharge under any river flow conditions.	More costly.
Gravity Flow	Better reliability than pumping.	Discharge is not possible during extreme flood conditions.
	Lower operation and maintenance costs.	Bypass line and additional emergency outlets required.
Above Surface Discharge		Can result in occasional fogging; more extensive end treatment to ensure energy dissipation; less mixing and thermal dispersion.
Below Surface Discharge	Better mixing and thermal dispersion.	
	Less noticeable.	
Offshore Discharge	Helps provide access for dilution water around entire periphery of thermal plume and improve dispersion.	Could cause high surface velocities.
Nearshore Discharge		Reduced river velocities as a result of mooring cells and unloading facilities would result in decreased dispersion capabilities.

TABLE 3.4.7-5

TRANSMISSION SYSTEMS

System	Advantages	Disadvantages
Eight 138-kV Overhead Lines		Increased visual impact over 345-kV lines Greater use of natural resources in construction of lines, including right-of-way requirements Increased nuisance to population during construction Increased cost to operate lines
Three 345-kV Overhead Lines	Compared to eight 138-kV lines, less visual and noise impact and reduced use of natural resources	
Underground Oil-Filled Pipe-Type Cable	No visual impact	Recommended only for relatively short lines Limitations on lengths of cable necessitate line splicing Additional pumping facilities required Cost 12 times greater than for overhead line

TABLE 3.4.7-6

PROPOSED PLANT SYSTEMS AND PREFERRED COMPONENTS TRIMBLE COUNTY GENERATING PLANT

System	Component
WASTE HEAT REJECTION SYSTEM	
Closed Cycle System	Hyperbolic Natural Draft Cooling Towers
ATMOSPHERIC POLLUTION CONTROL SYSTEM	
SO_2 Control System	
Flue Gas Desulfurization	Wet Limestone Scrubbing
Particulate Control System	Electrostatic Precipitator
NO_x Control System	To Be Determined by Boiler Manufacturer
PLANT WATER USE SYSTEM	
Water Sources	Ohio River Water
Wastewater Discharge	
Plant Process Wastewater	No Discharge
Sanitary Wastewater	No Discharge
Cold-Side Cooling Tower Blowdown	Discharge to River
Site Runoff	Discharge from Retention Basin to River
INTAKE STRUCTURE	
Location	Near Cells Supporting the Coal Barge Unloader
Design	Conventional
DISCHARGE STRUCTURE	
Location	Below Surface, Offshore
Method of Conveyance	Gravity Flow, Buried Conduit
Port Design	Cluster of Four Buried Pipes with Four Submerged Nozzles
SOLID WASTE DISPOSAL SCHEME	
Disposal Arrangements	Scheme 2
Handling Approaches	Approach D
TRANSMISSION SYSTEM	345-kV Overhead Lines

4.0 PROPOSED PROJECT

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4.0 PROPOSED PROJECT

4.1 LOCATION AND PLAN OF PROJECT

The proposed Trimble County Generating Plant site lies in the west-central part of Trimble County, Kentucky, about 50 miles northeast of Louisville. The site is 5.6 miles due west of Bedford, the county seat, and consists of approximately 2,300 acres bordering the eastern shore of the Ohio River between Ohio River Miles 570 and 572. The topography of the site rises from the normal level of the Ohio River at 420 feet above mean sea level to the tops of the bluffs at elevations of 750 to 800 feet above mean sea level. The land bordering the river is low and flat and lies no more than about 20 feet above the river surface at normal pool. The site has about 12,000 feet of river frontage. Drainage on the site is toward the west into the Ohio River, which flows roughly from north to south in this area.

There are no major highways or railroads within approximately 6 miles of the site. The only access by land is State Road 1488.

The proposed Trimble County Generating Plant site layout is presented on Figure 4.1-1. The plant boundaries on this figure indicate only the land that has been purchased by the Applicant (1,000 acres). An additional 1,300 acres of land in the two ravines to the northeast of the site (see Section 4.2.5) will need to be purchased for scrubber sludge disposal. An aerial photo of the site is presented on Figure 4.1-2.

Most of the proposed plant will be constructed on the flat topography of the site. Except in the ravines to be used for solid waste disposal, the remaining trees on the site will be preserved. After construction is complete, the remaining open areas of the property will be appropriately landscaped. An appropriately landscaped screening berm will be constructed to screen the plant from Wises Landing.

Overhead transmission lines carrying 345 kV will enter the switching station on the site adjacent to and east of the power plant.

The proposed Trimble County Generating Plant will ultimately consist of four coal-fired steam generating units with a total net generating capacity of 2,340 MW. Units 1 and 2 will have a net generating capacity of 495 MW per unit; Units 3 and 4 will have a net generating capacity of 675 MW per unit.

The boiler firing rate for Units 1 and 2 will be approximately 464,000 lb of coal per hour per unit; for Units 3 and 4, the boiler firing rate will be approximately 632,750 lb of coal per hour per unit.

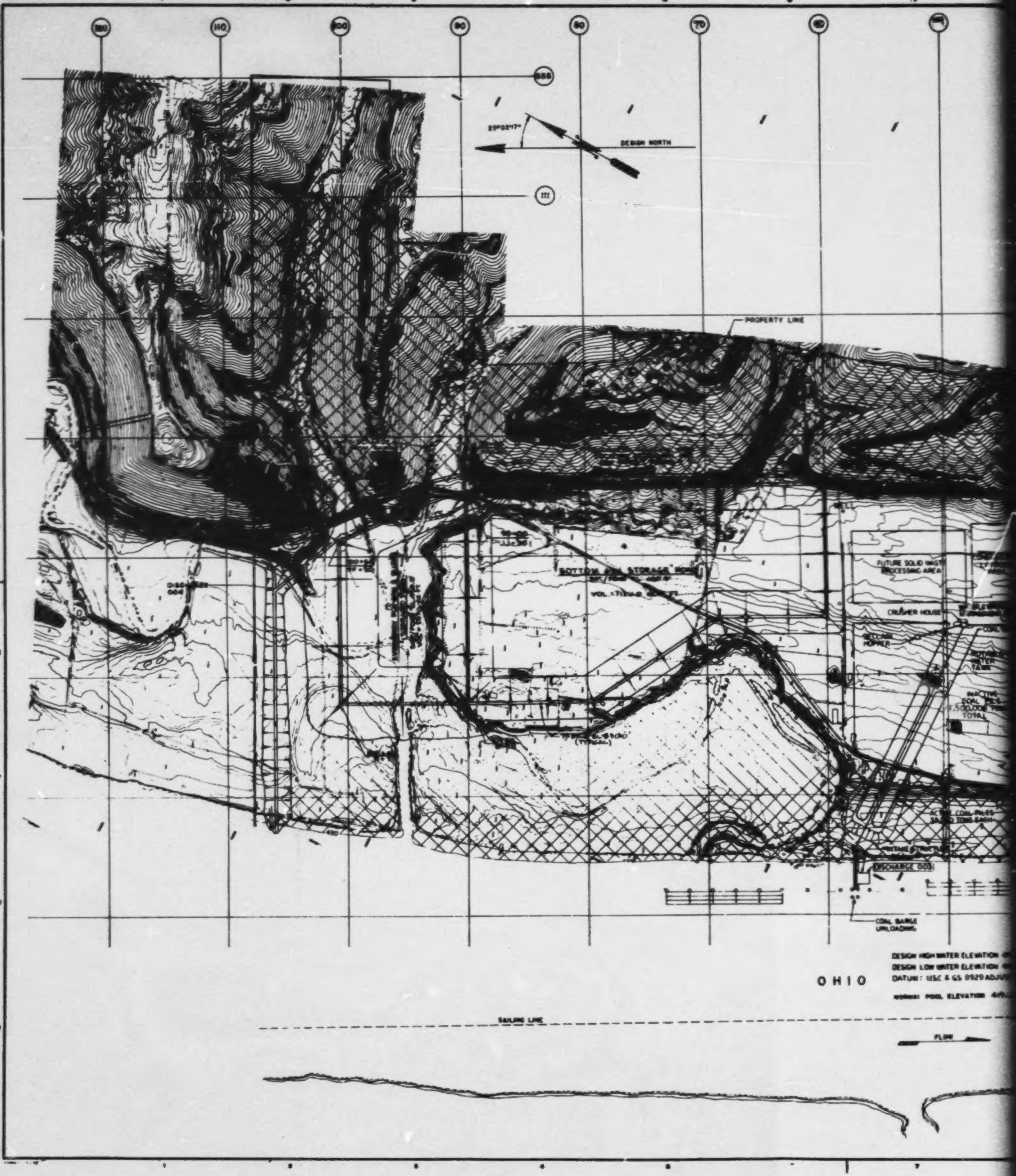
Coal will be delivered to the site by barges. Normal operation of all four units will require approximately five barge tows (approximately 15 barges per tow) per week to deliver the required amount of coal. Each barge will carry approximately 1,500 tons of coal.

The proposed site preparation starting date is July 1978. The anticipated construction and operation schedules of the plant are as follows:

	Start of Construction	Commercial Operation
Unit 1	March, 1979	June, 1983
Unit 2	October, 1981	June, 1985
Unit 3	October, 1983	June, 1987
Unit 4	October, 1985	June, 1989

The expected life of each unit is 30 years.

The following subsections describe the various systems and operating characteristics of the proposed generating plant.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100
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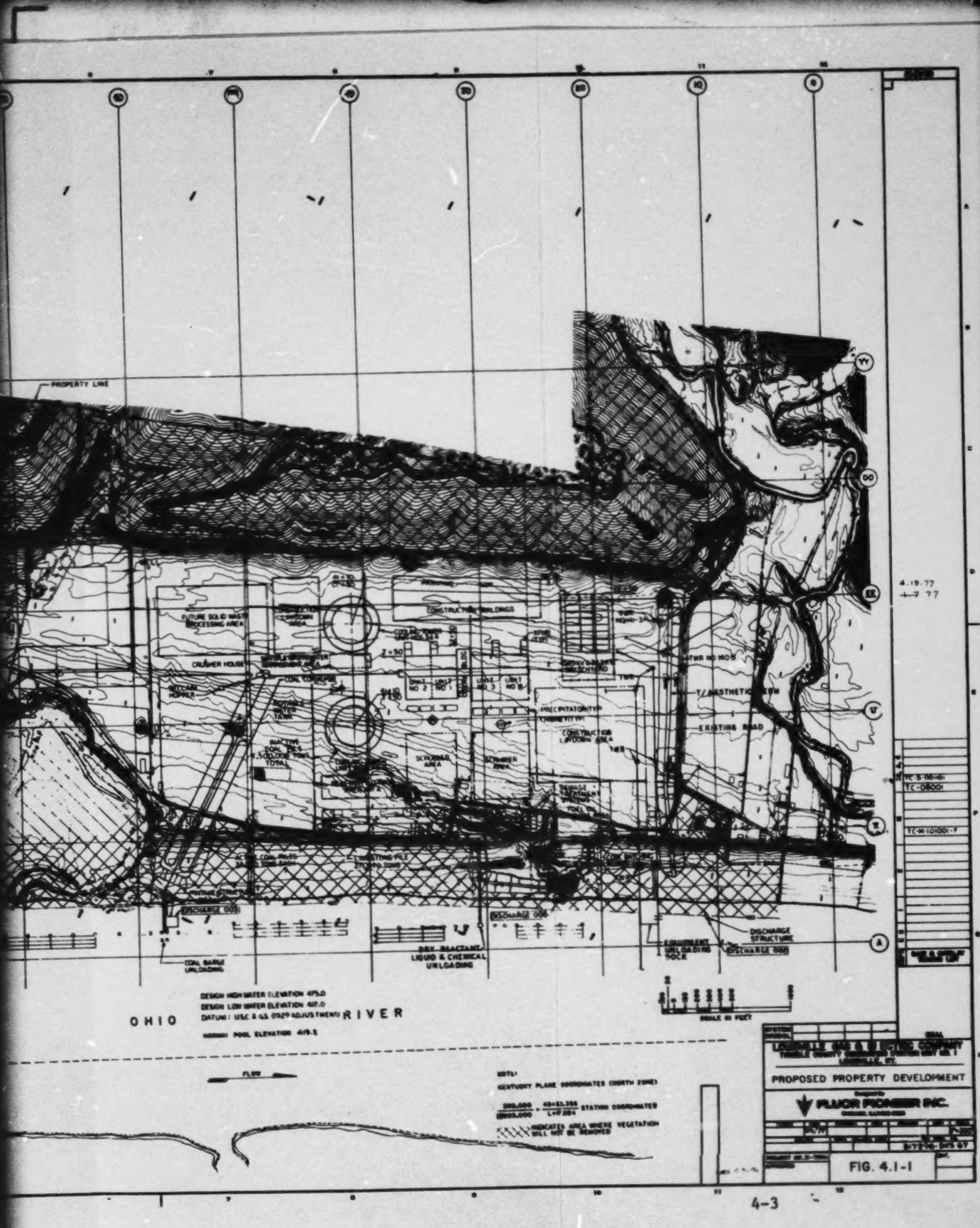
70
60
111
29°02'17"
DESIGN NORTH
PROPERTY LINE
BOTTOM ASH STORAGE POND
FUTURE SOLID WASTE PROCESSING AREA
CRUSHER HOUSE
HOPPER
TANK
INACTIVE COAL PILE
TOTAL
COAL PILES
DISCHARGE 001
COAL BARGE UNLOADING
DESIGN HIGH WATER ELEVATION
DESIGN LOW WATER ELEVATION
DATUM: USC & GS 1929 ADJU
POOL ELEVATION
OHIO
SAILING LINE
FLOW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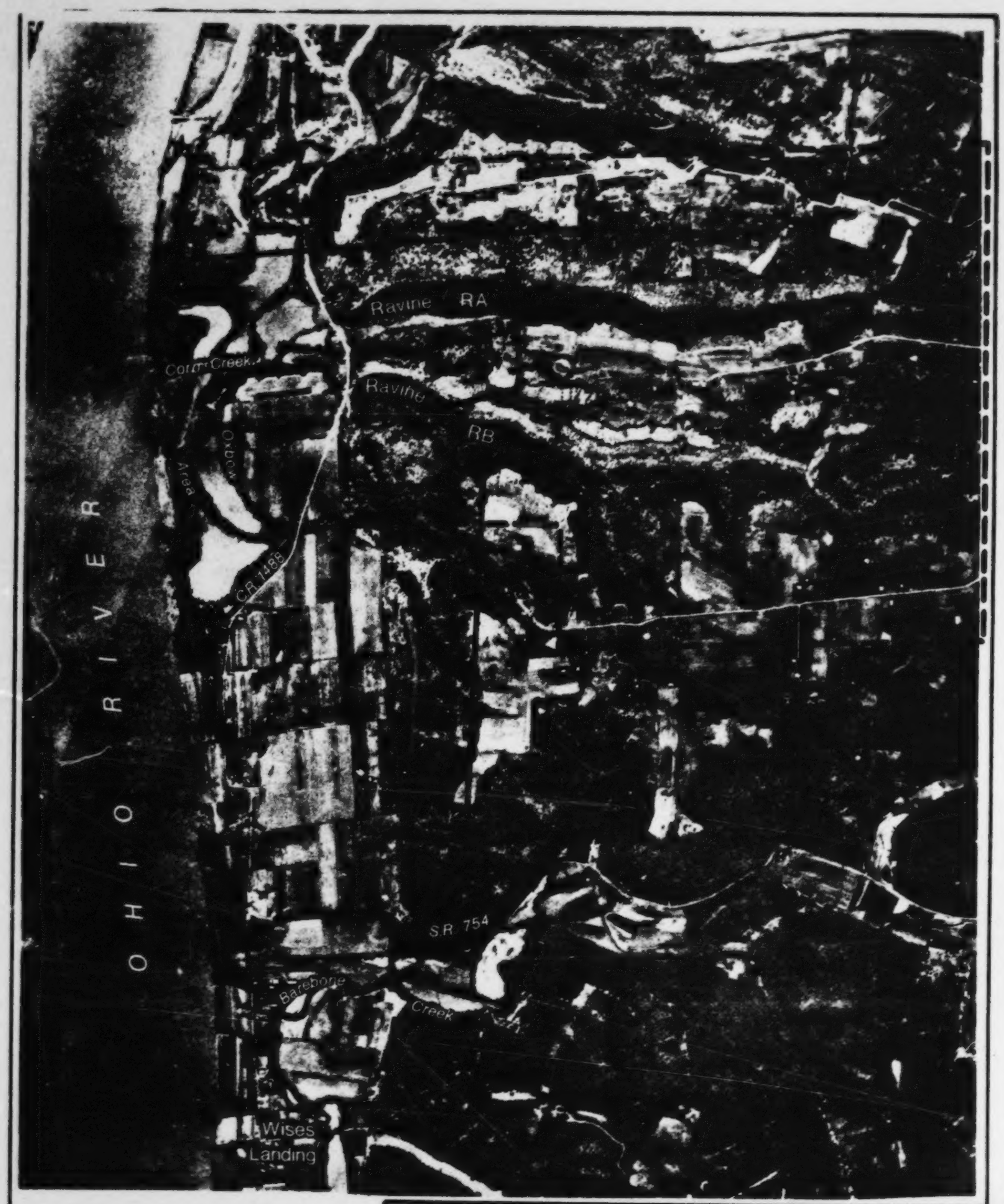
FUTURE SOLID WASTE PROCESSING AREA
CONSTRUCTION BUILDINGS
CRUSHER HOUSE
COAL CONVEYOR
HOPPER
UNIT NO 2
UNIT NO 1
UNIT NO 3
UNIT NO 4
PRECIPITATOR TYP
CONSTRUCTION LAYDOWN AREA
INACTIVE COAL PILE 1,500,000 TONS TOTAL
SCRUBBER AREA
SEWAGE TREATMENT SYSTEMS
FUEL OIL
Z+50
T/ AESTHETIC BERM
EXISTING ROAD
DISCHARGE 001
DISCHARGE 002
DISCHARGE 003
DISCHARGE STRUCTURE
COAL BARGE UNLOADING
DRY REACTANT LIQUID & CHEMICAL UNLOADING
EQUIPMENT UNLOADING DOCK
YY
DD
KK
A
TC-0800I
TC-M-10001-F
4-19-77
4-7-77
OHIO RIVER
DESIGN HIGH WATER ELEVATION 475.0
DESIGN LOW WATER ELEVATION 417.0
DATUM: USC & GS (1929 ADJUSTMENT)
NORMAL POOL ELEVATION 419.5
FLOW
SCALE IN FEET
NOTE:
KENTUCKY PLANE COORDINATES (NORTH ZONE)
STATION COORDINATES
INDICATES AREA WHERE VEGETATION WILL NOT BE REMOVED
LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY GENERATING STATION UNIT NO. 1
LOUISVILLE, KY.
PROPOSED PROPERTY DEVELOPMENT
FLUOR PIONEER INC.

FIG. 4.1-1


OHIO RIVER
Ravine RA
Corn Creek
Ravine RB
Oxbow Area
CR 1488
S.R. 754
Barebone Creek
Wises Landing
N

LEGEND:

——— PLANT SITE BOUNDARY

– – – PROPOSED BOUNDARY EXTENTION

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

PROPOSED PLANT SITE

FIGURE 4.1-2

4.2 PLANT ELEMENTS

4.2.1 General Description

The turbine generator, coal conveyor, boiler, air preheater, and air heater rooms will be located in the main building. Other structures and facilities to be located on the site are the construction facilities, precipitators, SO_2 removal equipment, chimneys, cooling towers, switching station, transmission towers, yard coal handling facilities, fuel oil storage area, barge unloading facilities, intake structure, discharge structure, and ash and solid waste process and disposal storage areas. The screening berm will be constructed along the southern boundary of the site

Construction Facilities

Construction facilities will be located at the south end and east side of the site in close proximity to the location of the main building. On the east side, there will be approximately 14 low profile buildings of prefabricated metal construction ranging in size from approximately 20 feet by 60 feet to 110 feet by 120 feet. In addition to these buildings, a construction parking lot for 580 automobiles will be located in the same general area. The concrete batching plant, including storage piles for sand and gravel and storage bins for cement and fly ash, will be located at the south end of the site between the main building and the Ohio River. In addition, construction laydown areas will be provided at the south end of the site and also north of the cooling tower for Units 3 and 4.

Main Building

The main building will enclose the turbine generator, coal conveyor, boiler, air preheater, and air heater rooms for all four units. Rectangular in shape, this building will be approximately 1,020 feet by 400 feet, approximately 300 feet in height above grade, and of structural steel construction enclosed with insulated metal siding.

Precipitators

Electrostatic precipitators will be located west of the main building. There will be two precipitators for each unit (a total of eight precipitators). Each precipitator will be approximately 110 feet long by 40 feet wide and approximately 105 feet high. These structures will be enclosed with insulation and metal siding. Breeching will carry flue gases; this will extend from the boiler outlet to the precipitator inlet and from the precipitator outlet to the induced draft fans located west of the precipitators. The breeching and induced draft fans will be covered with insulated metal siding and will be like the precipitators in appearance.

SO_2 Removal Equipment

The SO_2 removal equipment will be located west of the precipitators. The appearance of this facility will be determined after the manufacturer has been selected. Insulated metal breeching, carrying the flue gases from the induced draft fans, will enter the facility. The breeching will then extend from the SO_2 removal facility to the chimney, where the cleaned gases will be discharged to the atmosphere. Associated with the SO_2 removal equipment will be clarifiers, reactant storage tanks, and the SO_2 reactant storage pile. The SO_2 reactant, tentatively selected to be limestone, will be stored in an open pile between the Ohio River and the SO_2 removal equipment.

Chimneys

The chimneys (two) will consist of an exterior reinforced concrete shell with internal insulated steel liners. The chimneys will be 760 feet high, with an average outside diameter of approximately 60 feet. Each chimney will serve two units.

Cooling Towers

The cooling towers selected are hyperbolic natural draft towers of reinforced concrete construction. Units 1 and 2 will be served by a single cooling tower located northwest of the main plant. This tower will be approximately 400 feet high and have a base diameter of approximately 470 feet. Units 3 and 4 will be served by a single tower, approximately 500 feet high, with a base diameter of approximately 455 feet. This tower will be located northeast of the main building.

Switching Station and Transmission Towers

The 345-kV switching station will cover approximately 7.3 acres to the southeast side of the plant. The 345-kV station will have a low profile "breaker and a half" design and will be constructed of exposed galvanized steel A-frame structures. Both rigid and strain type aluminum buses will be used in the station. The switching station area will be enclosed by a chain link fence. The 345-kV transmission lines originating within the switching station will distribute power to an existing 345-kV transmission line that ties into Middletown substation, near Louisville, Kentucky, a distance of 27.5 miles, and to Clifty Creek substation at Madison, Indiana, a distance of 10.0 miles. The transmission towers will be located near the south boundary of the site. They will be built of galvanized steel and will be approximately 120 feet high.

Coal Handling Facilities

The coal handling facilities will be located north of the main building. They will extend from a barge unloader at the river front to the north end of the main plant, where the coal will be stored before being conveyed into the main building.

The main features of the coal handling facilities will be the barge unloader, sample house, transfer houses, stacker-reclaimer, crusher house, conveyors, and the active and inactive coal piles. Including the coal piles, the coal handling facilities will cover approximately 50 acres. The crusher and transfer houses will be of structural steel construction enclosed with metal siding. The conveyors will be enclosed and supported on structural steel frames.

Barge Unloading Facilities

There will be three facilities for unloading the following from barges: (1) equipment and construction materials; (2) limestone, oil, and chemicals; and (3) coal. Mooring cells will be located in the river for tie-up and maneuvering of barges.

Intake Structure

The intake structure (on the Ohio River) will be a reinforced concrete structure to elevation 475 feet. The screenhouse dimensions will be approximately 75 feet by 75 feet.

Discharge Structure

The discharge structure (on the Ohio River) will be a submerged reinforced concrete structure. It will be located downstream from the intake structure.

Ash and Scrubber Sludge Disposal Areas

The method of disposal for ash and scrubber sludge will be determined by the results of an ongoing research project (see Section 3.4.5). If the results of the research demonstrate that the proposed disposal scheme (described in Section 4.2.5) is acceptable, then there will be two disposal sites. Fly ash and scrubber sludge will be mixed with a chemical fixation agent in a process plant located near the two offsite ravines (see Figures 4.1-1 and 4.2.5-1). These two ravines, designated RA and RB, are adjacent to, and to the northeast of, the site. Ravine RA is 660 acres; Ravine RB is 780 acres (see Section 4.2.5).

Additional disposal will be available in an onsite disposal pond. This pond will have two compartments, one for fly ash and sludge and one for bottom ash. The fly ash and sludge compartment will provide emergency storage for fly ash and sludge when the process plant is inoperable. The bottom ash compartment will be sized to contain the bottom ash from all four units for the complete plant life. The onsite pond will be enclosed by an earthen roll-filled dike. Top elevation of both the external and the internal compartmental dike will be 530 feet above mean sea level. The river side of the external dike will be either heavily riprapped or seeded with crown vetch to prevent erosion. (A more detailed description of the disposal areas is presented in Section 4.2.5.)

Screening Berm

Construction of the screening berm (Figure 4.2.1-1) will begin in March 1978 and be completed by May 1978. Topsoil obtained from the clearing of the site will be used to construct the berm. The slope toward Wises Landing will be planted with grasses and trees. The trees will provide visual screening and will also absorb noise. A gravel maintenance road will be constructed on top of the berm.

4.2.2 Steam Electric System

The proposed Trimble County Generating Plant will consist of four electrical generating units. Units 1 and 2 will each have a net electrical output of 495 MW; Units 3 and 4 will each have a net electrical output of 675 MW. For each unit there will be a coal-fired steam generator that will supply high-pressure, superheated steam to the turbine generator. Steam will be supplied to the high-pressure section of the turbine at approximately 2,400 psig and 1,000°F. The steam will then return to the steam generator, where it will be reheated to approximately 1,000°F. This reheated steam will be returned first to the intermediate pressure section of the turbine at approximately 600 psig and then to the low-pressure section of the turbine. The mechanical energy produced in the turbine will be transmitted through a common shaft to the generator, where it will be converted into electric energy. The steam electric cycle is illustrated on Figure 4.2.2-1.

After giving up its usable heat energy, the steam will exhaust into a steam condenser. Cooling water required for condensing this exhaust steam will be provided by a closed circulating water system employing natural draft cooling towers. After condensation, the condensate will be pumped back to the steam generator, where it will be converted to steam. Before it is introduced into the steam generator, the condensate will be heated in a series of feedwater heaters. Steam from the turbine will provide the heat.

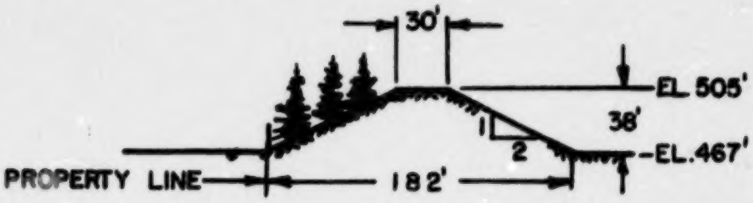
4.2.3 Plant Water Systems

The proposed plant water system will be discussed under two categories: (1) the means by which water is collected and discharged and (2) the way this water is used (including kinds, amounts, and treatment of wastewater). All numbers are maximum values expected during peak plant operation; over the course of the plant life, water intake and wastewater discharge will vary up to the expected maximum. The following discussion gives plant water use figures for the entire system (all four units and two cooling towers combined). Figure 4.2.3-1 depicts the 24-hour average flow of the combined system; Figure 4.2.3-2 depicts the peak flow for th combined system; and Figure 4.2.3-3 depicts the 24-hour average flow for one unit.

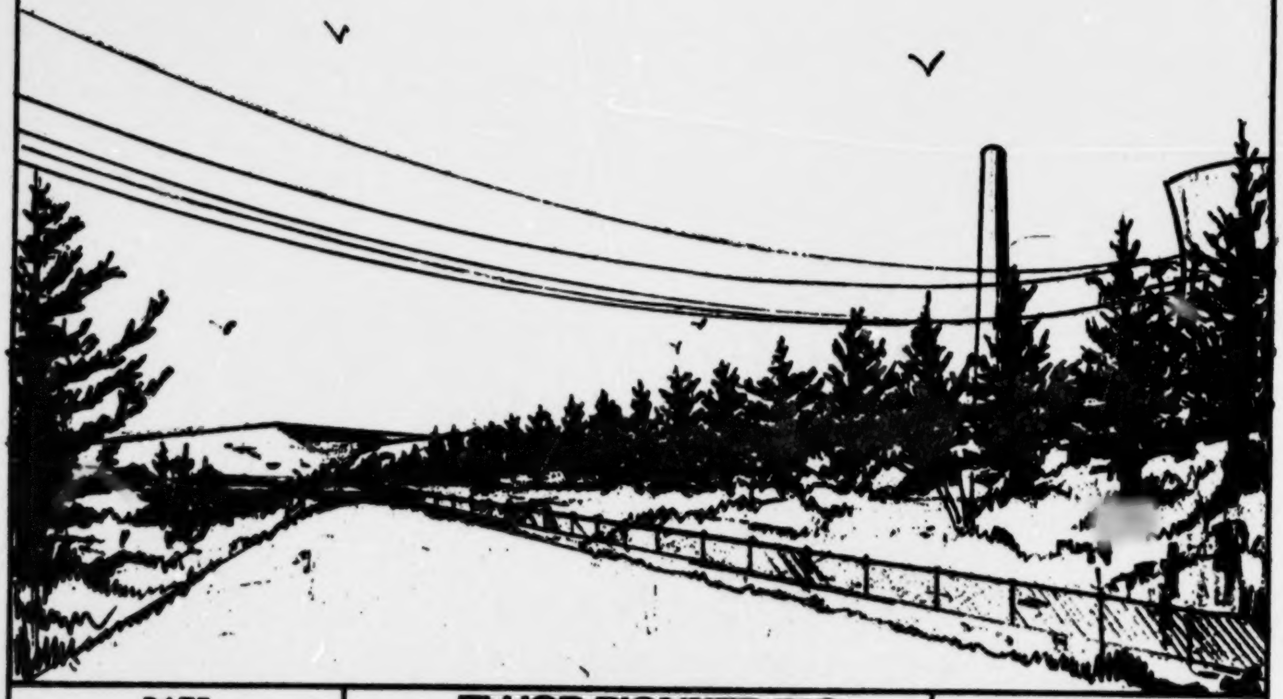
Plant Intake and Discharge Structures

Intake Structure

A conventional intake structure (described in Section 3.4.4 and illustrated on Figure 3.4.4-2) is proposed for the Trimble County Generating Plant. This structure is to be located near the cells supporting the coal barge unloader. The intake structure will employ vertical traveling screens and will include openings in the sidewalls to allow fish entering the screen wells to swim laterally across the face of the screens and back into the river.

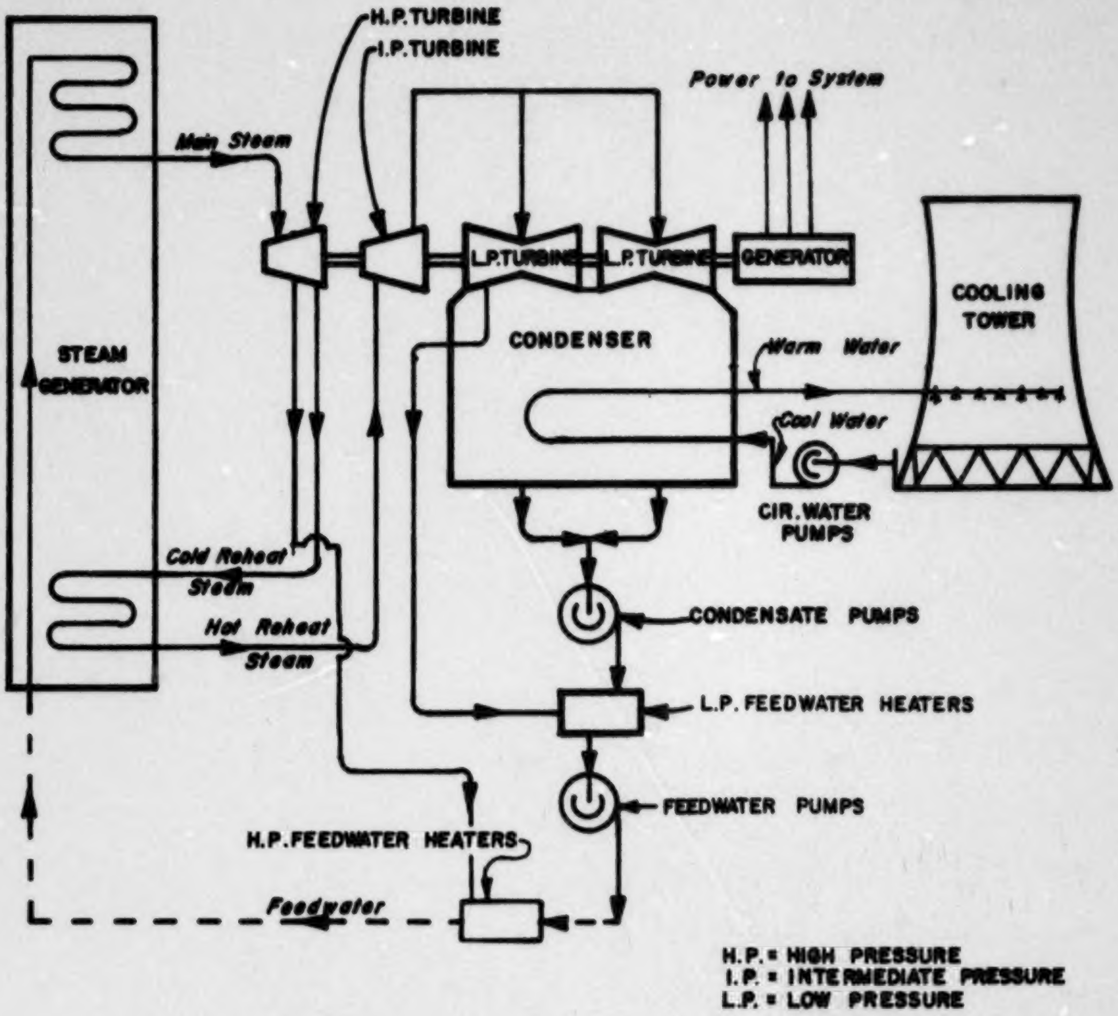

30'
EL. 505'
38'
1
2
EL. 467'
PROPERTY LINE
182'

CROSS SECTION OF BERM



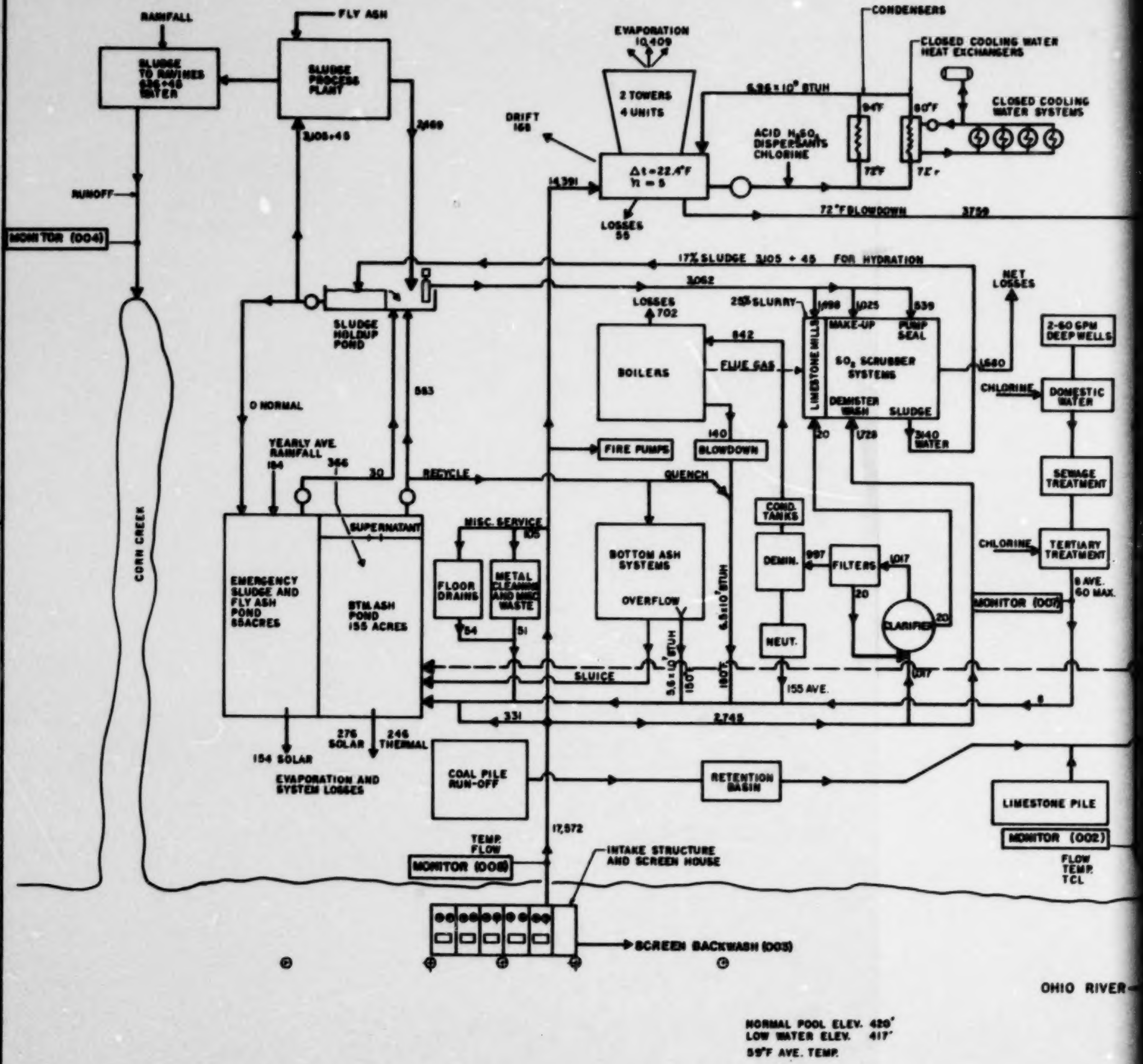
DATE	FLUOR PIONEER INC.	STANDARD DETAIL
	SCREENING BERM LOOKING WEST	SHT
		FIG. 4.2.1-1

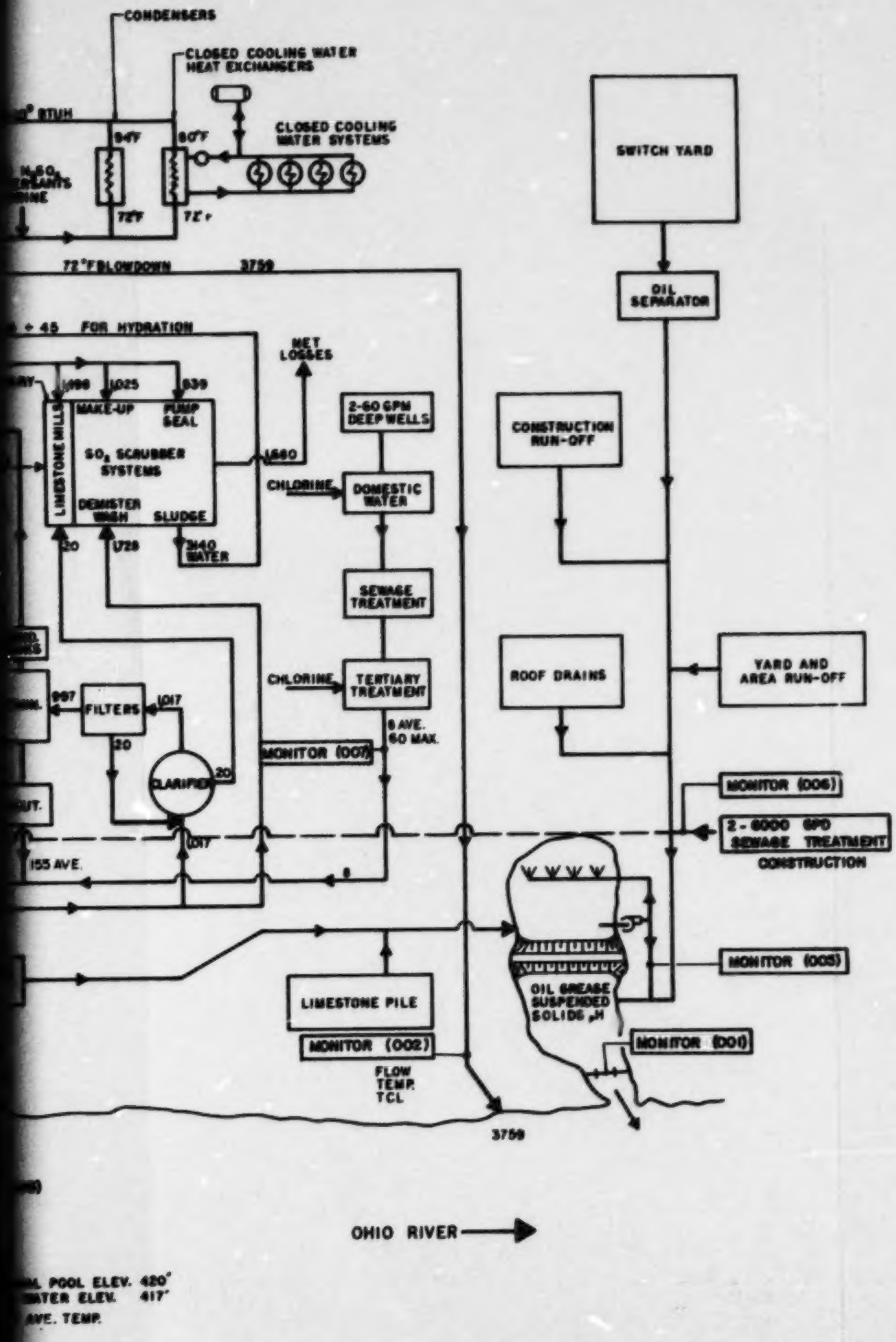
FORM C-312 11/1/74


H.P. TURBINE
I.P. TURBINE
Power to System
Main Steam
L.P. TURBINE
L.P. TURBINE
GENERATOR
COOLING TOWER
STEAM GENERATOR
CONDENSER
Warm Water
Cool Water
CIR. WATER PUMPS
Cold Reheat Steam
Hot Reheat Steam
CONDENSATE PUMPS
L.P. FEEDWATER HEATERS
FEEDWATER PUMPS
H.P. FEEDWATER HEATERS
Feedwater
H.P. = HIGH PRESSURE
I.P. = INTERMEDIATE PRESSURE
L.P. = LOW PRESSURE

DATE	**FLUOR PIONEER INC.**	DESIGN GUIDE
	LOUISVILLE GAS & ELECTRIC COMPANY TRIMBLE COUNTY PLANT SITE	SHT OF
	STEAM ELECTRIC SYSTEM CYCLE	FIG. 4.2.2-1

FORM C-313 10/74


RAINFALL
SLUDGE TO RAVINES 426+45 WATER
FLY ASH
SLUDGE PROCESS PLANT
3,105+45
2,469
RUNOFF
MONITOR (004)
CORN CREEK
SLUDGE HOLDUP POND
0 NORMAL
583
YEARLY AVE. RAINFALL 184
366
30
RECYCLE
EMERGENCY SLUDGE AND FLY ASH POND 85ACRES
SUPERNATANT
BTM ASH POND 155 ACRES
154 SOLAR
276 SOLAR
246 THERMAL
EVAPORATION AND SYSTEM LOSSES
MISC. SERVICE 105
FLOOR DRAINS
METAL CLEANING AND MISC WASTE
54
51
EVAPORATION 10,409
2 TOWERS 4 UNITS
DRIFT 168
14,391
Δt = 22.4°F
n = 5
LOSSES 55
6.96 × 10⁹ BTUH
CONDENSERS
CLOSED COOLING WATER HEAT EXCHANGERS
ACID H₂SO₄ DISPERSANTS CHLORINE
94°F
80°F
72°F
72°F
CLOSED COOLING WATER SYSTEMS
72°F BLOWDOWN
3759
17% SLUDGE 3,105 + 45 FOR HYDRATION
3,062
LOSSES 702
25% SLURRY
1,698
1,025
539
NET LOSSES
BOILERS
842
FLUE GAS
LIMESTONE MILLS
MAKE-UP
PUMP SEAL
SO₂ SCRUBBER SYSTEMS
DEMISTER WASH
SLUDGE
1,680
20
1,728
3,140 WATER
140
FIRE PUMPS
BLOWDOWN
QUENCH
BOTTOM ASH SYSTEMS
OVERFLOW
5.6 × 10⁷ BTUH
150°F
6.5 × 10⁷ BTUH
180°F
SLUICE
COND. TANKS
DEMIN.
997
FILTERS
1,017
20
CLARIFIER
20
1,017
NEUT.
155 AVE.
331
2,745
8
2-60 GPM DEEP WELLS
CHLORINE
DOMESTIC WATER
SEWAGE TREATMENT
CHLORINE
TERTIARY TREATMENT
8 AVE. 60 MAX.
MONITOR (007)
COAL PILE RUN-OFF
RETENTION BASIN
LIMESTONE PILE
MONITOR (002)
FLOW TEMP. TCL
17,572
TEMP. FLOW
MONITOR (008)
INTAKE STRUCTURE AND SCREEN HOUSE
SCREEN BACKWASH (003)
OHIO RIVER
NORMAL POOL ELEV. 420'
LOW WATER ELEV. 417'
59°F AVE. TEMP.


CONDENSERS
CLOSED COOLING WATER HEAT EXCHANGERS
CLOSED COOLING WATER SYSTEMS
BTUH
94°F
80°F
72°F
72°F
72°F BLOWDOWN
3759
+ 45 FOR HYDRATION
NET LOSSES
1098
1025
839
MAKE-UP
PUMP SEAL
LIMESTONE MILLS
SO_2 SCRUBBER SYSTEMS
DEMISTER WASH
SLUDGE
1660
20
1728
3140 WATER
2-60 GPM DEEP WELLS
CHLORINE
DOMESTIC WATER
SEWAGE TREATMENT
CHLORINE
TERTIARY TREATMENT
8 AVE.
60 MAX.
MONITOR (007)
997
FILTERS
1017
20
CLARIFIER
20
1017
155 AVE.
8
SWITCH YARD
OIL SEPARATOR
CONSTRUCTION RUN-OFF
ROOF DRAINS
YARD AND AREA RUN-OFF
MONITOR (006)
2-6000 GPD SEWAGE TREATMENT
CONSTRUCTION
OIL GREASE SUSPENDED SOLIDS ,H
MONITOR (005)
LIMESTONE PILE
MONITOR (002)
FLOW
TEMP.
TCL
MONITOR (001)
3759
OHIO RIVER
AL POOL ELEV. 420'
ATER ELEV. 417'
AVE. TEMP.

YEARLY AVERAGES

56.6°F DRY BULB
50.8°F WET BULB
68.6% RELATIVE HUMIDITY

NOTE:
ALL FLOWS ARE GPM WATER ONLY

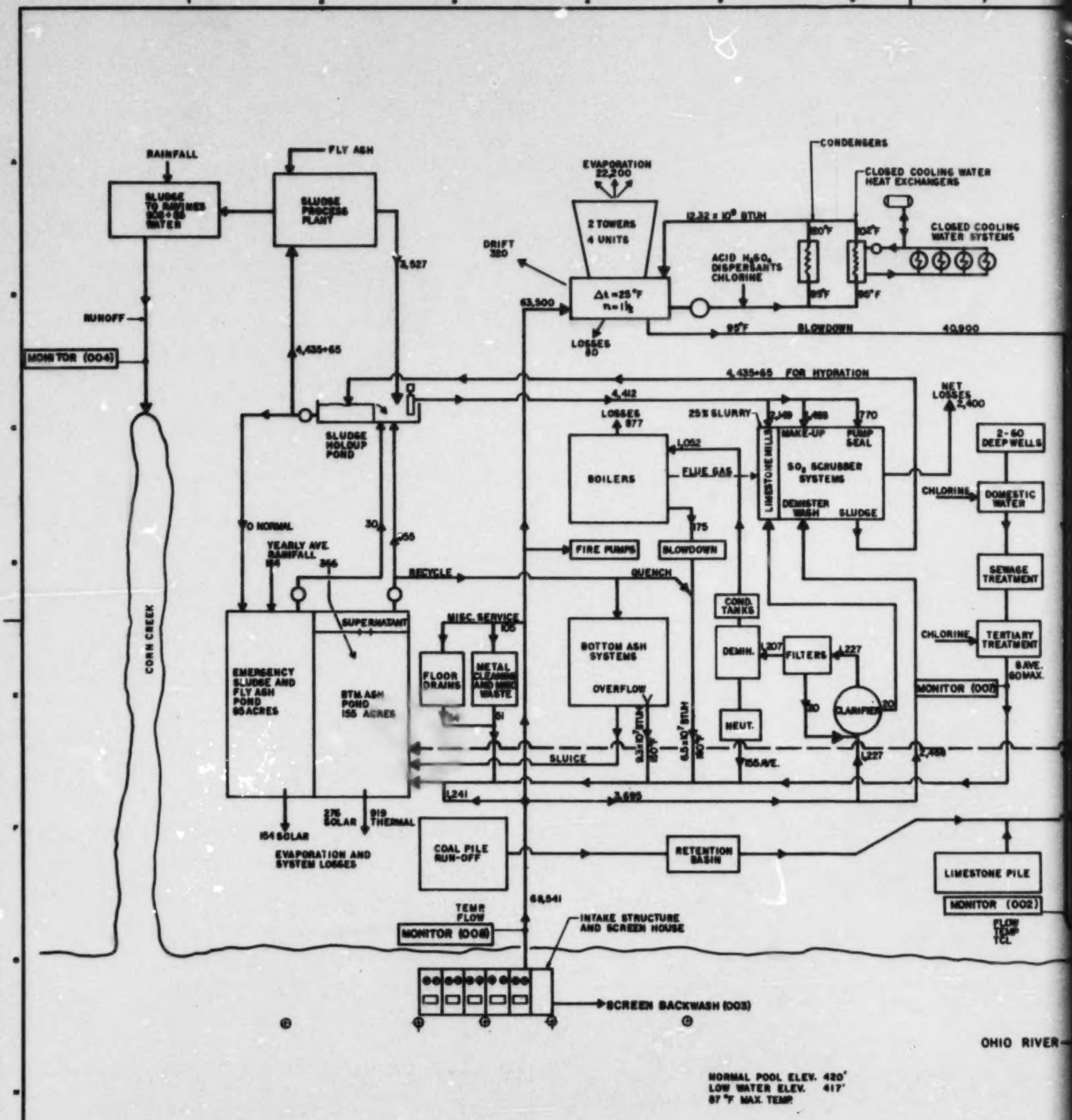
← — — DISCHARGE OF CONSTRUCTION SEWAGE TREATMENT WASTEWATER TO BOTTOM ASH POND AFTER POND IS CONSTRUCTED

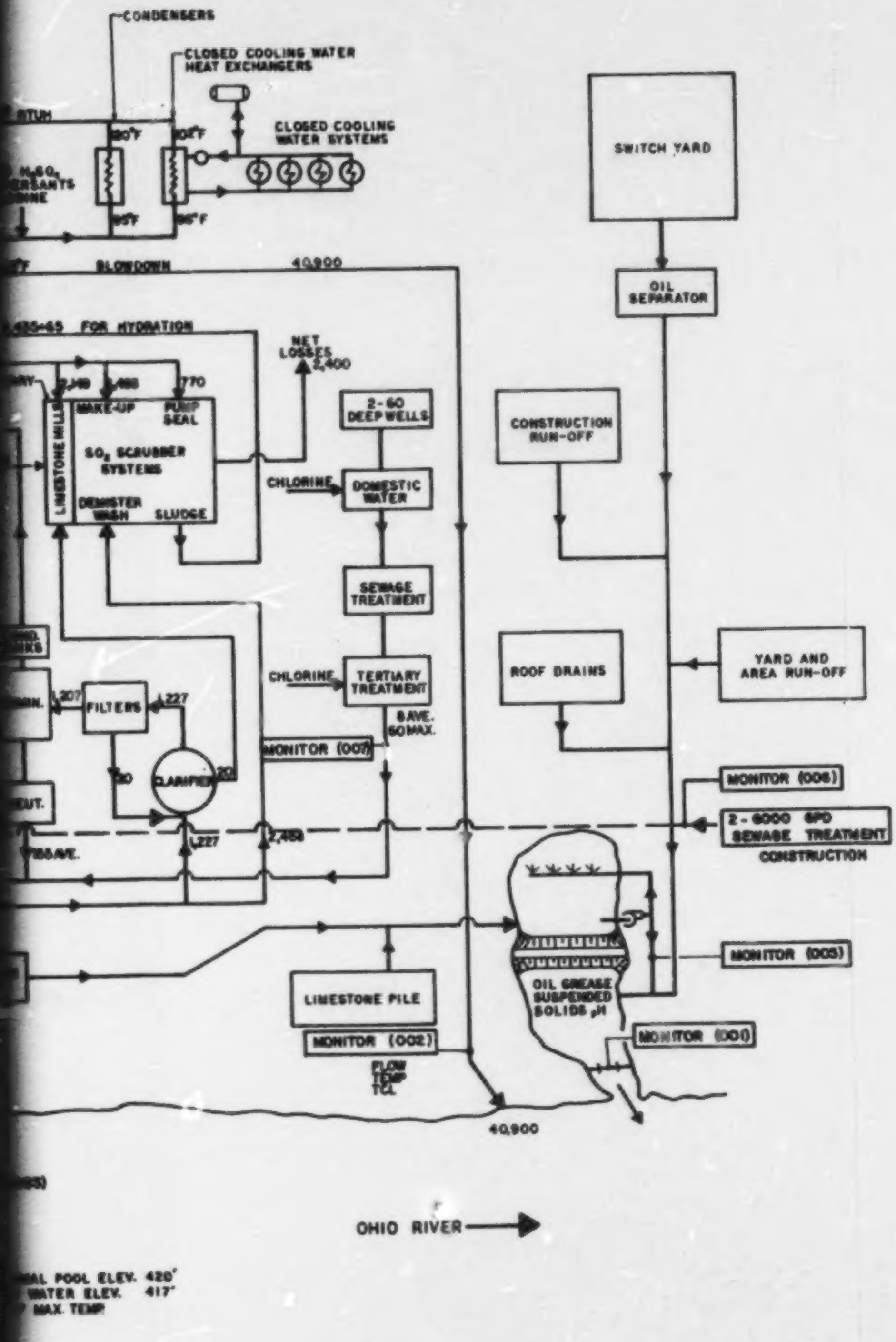
LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE

STATION WATER USE PLAN
24 HR. AVERAGE FLOW

FLUOR PIONEER INC.

FIGURE 4.2.3-1


RAINFALL
FLY ASH
SLUDGE TO RAVINES 306+60 WATER
SLUDGE PROCESS PLANT
3,527
RUNOFF
MONITOR (004)
4,435+65
SLUDGE HOLDUP POND
CORN CREEK
0 NORMAL
YEARLY AVE. RAINFALL 184
366
30
355
RECYCLE
SUPERNATANT
EMERGENCY SLUDGE AND FLY ASH POND 85 ACRES
BTM. ASH POND 155 ACRES
154 SOLAR
275 SOLAR
919 THERMAL
EVAPORATION AND SYSTEM LOSSES
EVAPORATION 22,200
2 TOWERS
4 UNITS
DRIFT 320
Δt = 25°F
n = 1½
63,500
LOSSES 80
12.32 x 10⁹ BTUH
CONDENSERS
CLOSED COOLING WATER HEAT EXCHANGERS
CLOSED COOLING WATER SYSTEMS
ACID H₂SO₄ DISPERSANTS CHLORINE
120°F
102°F
95°F
90°F
95°F
BLOWDOWN
40,900
4,435+65 FOR HYDRATION
4,412
NET LOSSES 2,400
LOSSES 877
25% SLURRY
2,149
1,488
770
MAKE-UP
PUMP SEAL
LIMESTONE MILLS
SO₂ SCRUBBER SYSTEMS
DEMISTER WASH
SLUDGE
BOILERS
1,052
FLUE GAS
175
FIRE PUMPS
BLOWDOWN
QUENCH
2-60 DEEP WELLS
CHLORINE
DOMESTIC WATER
SEWAGE TREATMENT
CHLORINE
TERTIARY TREATMENT
8 AVE. 60 MAX.
MONITOR (007)
MISC. SERVICE
105
FLOOR DRAINS
METAL CLEANING AND MISC WASTE
54
51
BOTTOM ASH SYSTEMS
OVERFLOW
9.3 x 10⁷ BTUH
6.5 x 10⁷ BTUH
COND. TANKS
DEMIN.
1,207
FILTERS
1,227
20
CLARIFIER
20
NEUT.
155 AVE.
SLUICE
1,227
2,488
1,241
3,695
COAL PILE RUN-OFF
RETENTION BASIN
LIMESTONE PILE
MONITOR (002)
FLOW TEMP TCL
68,541
TEMP. FLOW
MONITOR (008)
INTAKE STRUCTURE AND SCREEN HOUSE
SCREEN BACKWASH (003)
OHIO RIVER
NORMAL POOL ELEV. 420'
LOW WATER ELEV. 417'
87 °F MAX. TEMP.



CONDENSERS
CLOSED COOLING WATER HEAT EXCHANGERS
CLOSED COOLING WATER SYSTEMS
BTUH
H₂SO₄
ERSANTS
ORINE
120°F
102°F
95°F
96°F
BLOWDOWN
40,900
2,435-65 FOR HYDRATION
NET LOSSES 2,400
2,140
1,488
770
LIMESTONE MILLS
MAKE-UP
PUMP SEAL
SO₂ SCRUBBER SYSTEMS
DEMISTER WASH
SLUDGE
2-60 DEEP WELLS
CHLORINE
DOMESTIC WATER
SEWAGE TREATMENT
CHLORINE
TERTIARY TREATMENT
8 AVE. 60 MAX.
SWITCH YARD
OIL SEPARATOR
CONSTRUCTION RUN-OFF
ROOF DRAINS
YARD AND AREA RUN-OFF
FILTERS
1,207
1,227
20
CLARIFIER
20
1,227
2,488
155 AVE.
MONITOR (007)
MONITOR (006)
2 - 6000 GPD SEWAGE TREATMENT
CONSTRUCTION
OIL GREASE SUSPENDED SOLIDS pH
MONITOR (003)
LIMESTONE PILE
MONITOR (002)
FLOW TEMP TCL
MONITOR (001)
40,900
OHIO RIVER
IAL POOL ELEV. 420'
WATER ELEV. 417'
MAX. TEMP.

YEARLY PEAK
101 °F DRY BULB
80 °F WET BULB
100 % RELATIVE HUMIDITY

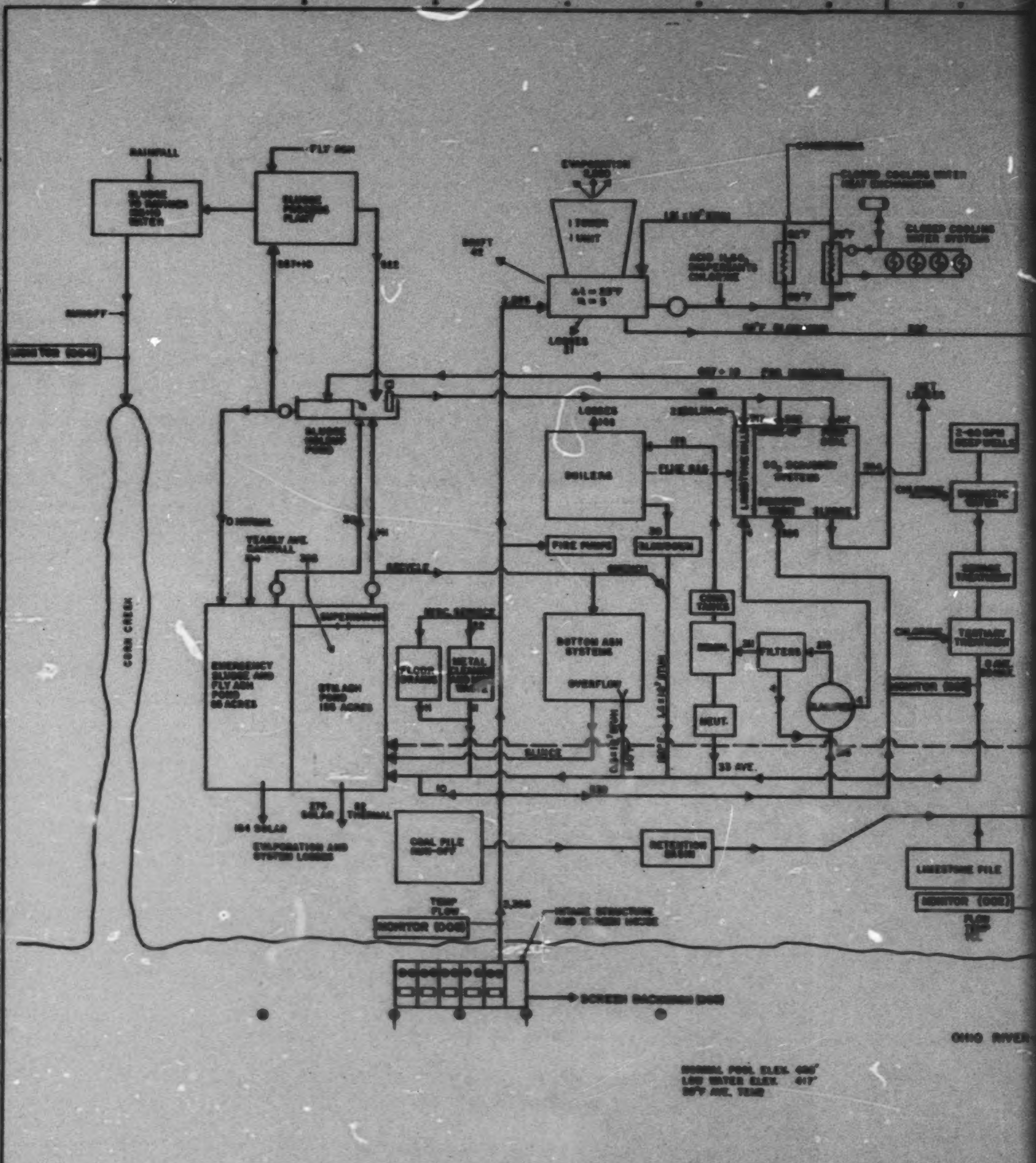
NOTE:
ALL FLOWS ARE GPM WATER ONLY

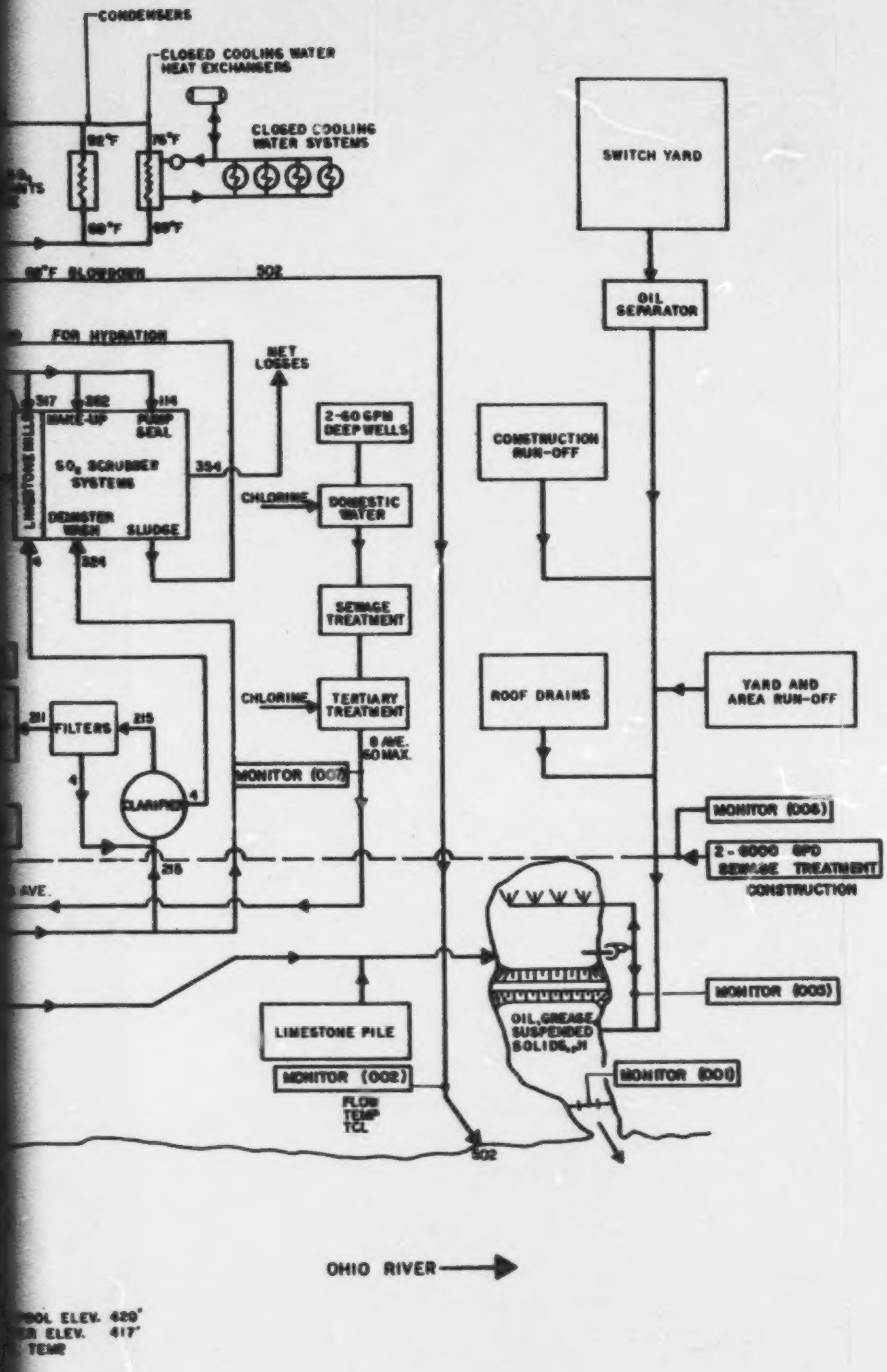
← — — DISCHARGE OF CONSTRUCTION SEWAGE TREATMENT WASTEWATER TO BOTTOM ASH POND AFTER POND IS CONSTRUCTED

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE
STATION WATER USE PLAN
PEAK FLOW

FLUOR PIONEER INC.

FIGURE 4.2.3-2


RAINFALL
FLY ASH
SLUDGE PROCESSING PLANT
RUNOFF
MONITOR (004)
DRIFT 42
EVAPORATION
1 TOWER
1 UNIT
LOSSES 21
CONDENSERS
CLOSED COOLING WATER HEAT EXCHANGERS
CLOSED COOLING WATER SYSTEMS
ACID H2SO4 DISPERSANTS CHLORINE
BLOWDOWN
SLUDGE HOLDUP POND
LOSSES
BOILERS
FLUE GAS
SO2 SCRUBBER SYSTEMS
NET LOSSES
DEEP WELLS
DOMESTIC WATER
SEWAGE TREATMENT
TERTIARY TREATMENT
CHLORINE
YEARLY AVE. RAINFALL
RECYCLE
FIRE PUMPS
BLOWDOWN
COND. TANKS
DEMIN.
FILTERS
NEUT.
SUPERNATANT
MISC. SERVICE
FLOOR DRAINS
METAL CLEANING
EMERGENCY SLUDGE AND FLY ASH POND 85 ACRES
STILASH POND 186 ACRES
BOTTOM ASH SYSTEMS
OVERFLOW
SLUICE
33 AVE.
164 SOLAR
276 SOLAR
92 THERMAL
EVAPORATION AND SYSTEM LOSSES
COAL PILE RUN-OFF
RETENTION BASIN
LIMESTONE PILE
MONITOR (003)
MONITOR (002)
TEMP FLOW
INTAKE STRUCTURE AND SCREEN HOUSE
SCREEN BACKWASH
CORN CREEK
OHIO RIVER
NORMAL POOL ELEV. 420'
LOW WATER ELEV. 417'
AVE. TEMP


CONDENSERS
CLOSED COOLING WATER HEAT EXCHANGERS
CLOSED COOLING WATER SYSTEMS
92°F
76°F
69°F
69°F
°F BLOWDOWN
502
FOR HYDRATION
NET LOSSES
317
262
114
MAKE-UP
PUMP SEAL
LIMESTONE MILLS
SO₂ SCRUBBER SYSTEMS
354
DEMISTER WASH
SLUDGE
4
324
2-60 GPM DEEP WELLS
CHLORINE
DOMESTIC WATER
SEWAGE TREATMENT
CHLORINE
TERTIARY TREATMENT
8 AVE. 60 MAX.
MONITOR (007)
211
FILTERS
215
4
CLARIFIER
4
218
AVE.
SWITCH YARD
OIL SEPARATOR
CONSTRUCTION RUN-OFF
ROOF DRAINS
YARD AND AREA RUN-OFF
MONITOR (006)
2-6000 GPD SEWAGE TREATMENT
CONSTRUCTION
MONITOR (003)
OIL, GREASE, SUSPENDED SOLIDS, pH
MONITOR (001)
LIMESTONE PILE
MONITOR (002)
FLOW
TEMP
TCL
502
OHIO RIVER
POOL ELEV. 420'
ER ELEV. 417'
TEMP

YEARLY AVERAGES

56.6°F DRY BULB
50.8°F WET BULB
69.6 % RELATIVE HUMIDITY

NOTE:
ALL FLOWS ARE GPM WATER ONLY

← — — DISCHARGE OF CONSTRUCTION SEWAGE TREATMENT WASTEWATER TO BOTTOM ASH POND AFTER POND IS CONSTRUCTED

LOUISVILLE GAS & ELECTRIC COMPANY
TRIMBLE COUNTY PLANT SITE

ONE UNIT WATER USE PLAN
24 HR AVERAGE FLOW

FLUOR PIONEER INC.

FIGURE 4.2.3-3

The trash racks will cover the full width of the pump bays and will extend from near the natural river bottom to an elevation of 435 feet. This will provide screen approach velocities that are as uniform as possible. These velocities will not exceed 0.5 feet per second.

Debris from the trash racks will be collected and transported to the plant site or other suitable area for disposal. Screen washings will be returned to the river. Makeup water will be pumped to the plant by long-shaft vertical centrifugal pumps.

Discharge Structures

Cooling System Water. A direct discharge to the Ohio River of cooling tower blowdown will be provided through a submerged offshore outlet downstream of the intake structure. Gravity flow will be the method of conveyance for discharging the blowdown. At extreme high flood stages, when gravity discharge from the primary outlet is not possible, secondary outlets discharging into inundated areas will handle the effluent. The primary point of discharge will be at a point 80 feet offshore (normal pool level). A discharge velocity of 5 to 25 fps at an angle to the river current will be used.

Runoff Discharge. A retention/treatment basin will be provided to handle stormwater runoff from the construction area, parking area, coal pile, limestone storage pile, roofs, and the switchyard. The system is designed to handle runoff from a 10-year, 24-hour storm.

Actual discharge from the treatment basin will vary as a function of precipitation. The discharge from the basin will be treated to adjust pH and remove oil, grease, and suspended solids. A monitor will ensure that the discharge meets EPA, state, and ORSANCO discharge standards.

Plant Water Uses

The Ohio River will be the source for makeup water for the proposed plant. Approximately 69,000 gpm (maximum) will be drawn into the plant for all plant uses. These uses are of two kinds: circulating water makeup and process water. Plant water requirements will vary with plant load. Total maximum requirements are shown on Figure 4.2.3-2.

Two deep wells will supply the domestic water needs of the approximately 350 operating personnel. The approximate maximum requirement from these wells will be 60 gpm each.

Circulating Water System

The circulating water system makeup requirements will be approximately 63,500 gpm maximum (1-1/2 cycles of circulation; 24-hour average makeup = 17,572 gpm at 5 cycles of circulation). This water is used in the closed-cycle circulating water system to replace evaporation, drift, blowdown, and other losses. The intake requirement and distribution per unit and cooling tower are diagrammed on Figure 4.2.3-4. Cooling tower operating characteristics are presented in Table 4.2.3-1.

Plant Process Water System

Maximum plant process make-up water requirements are approximately 5,500 gpm. This need is supplied by raw river water. This water is used to replace evaporation and system losses from the plant process water closed-cycle system, which provides water for the boilers, for ash sluicing and SO_2 removal, and for other plant uses.

Domestic Water Supply

The average amount of water required for the domestic uses of the operating personnel will be approximately 11,000 gallons per day.

Plant Wastewater Discharges

Circulating Water System

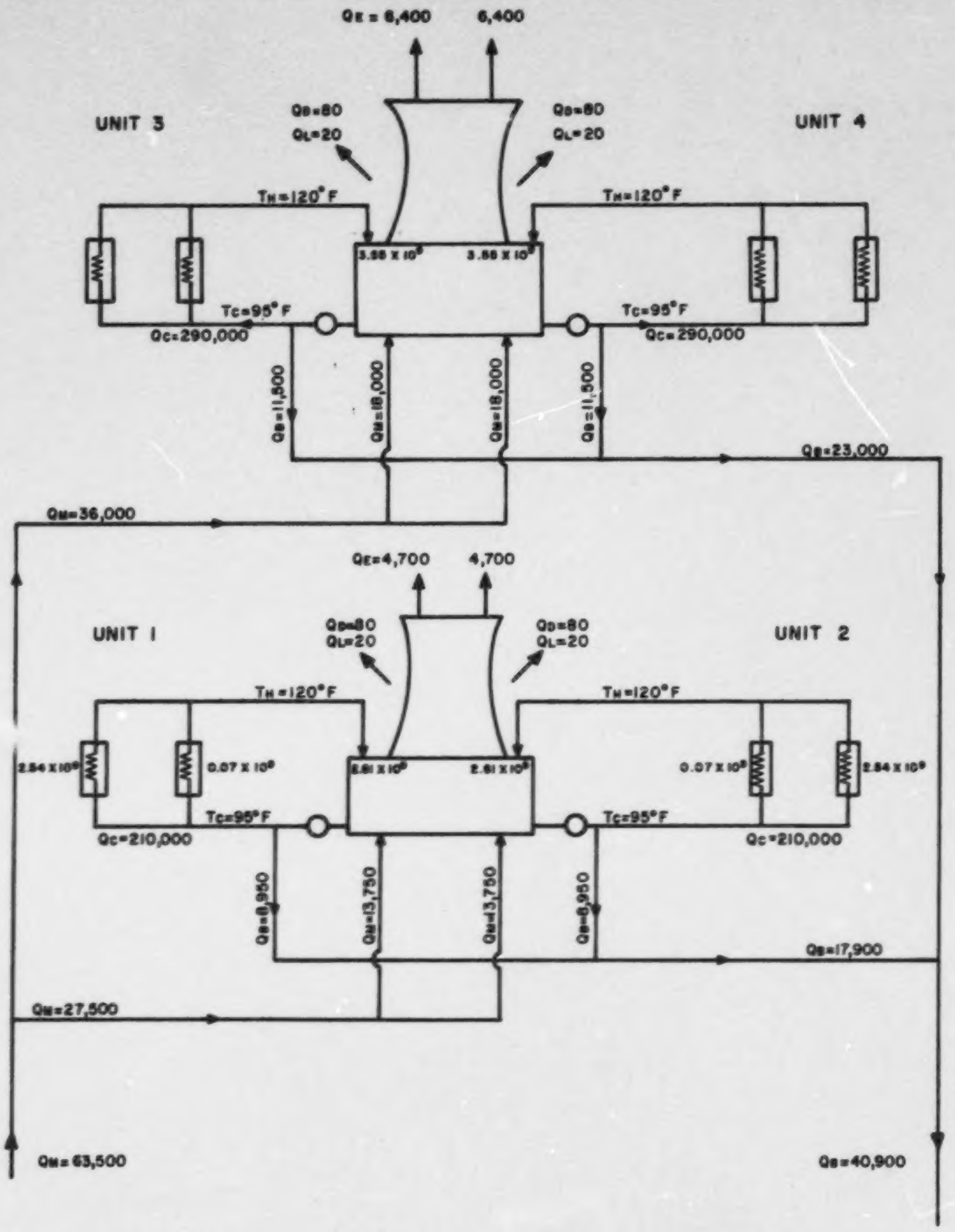
Discharge rate from the cold side of the closed-cycle circulating water system will be approximately 40,900 gpm (maximum peak, 1-1/2 cycles). Before this water is discharged to the Ohio River, the circulating water will be treated with sulfuric acid, dispersants, and chlorine. These chemicals will be in the water discharged to the Ohio River, as will also its thermal load. However, the discharge quality and thermal plume will not violate either federal or state standards, which are presented in Tables 4.2.3-2 and 4.2.3-3. Table 4.2.3-4 defines the kinds and amounts of treatment to be used in the plant water system.

In order to minimize chlorine requirements and to prevent the release of toxic levels of chlorine to the river, chlorine will be injected into the circulating water system at the condenser one unit at a time. Residual chlorine will pass with the cooling water through the cooling tower fill, which will facilitate its release. The remaining residual chlorine will then mix, in the cooling tower basin, with both river makeup water and the circulating water from the other generating units. This approach will reduce the chlorine and chloramine concentrations.

The cooling tower blowdown will be monitored before discharge to the Ohio River. Cooling tower blowdown characteristics are listed on Table 4.2.3-5.

Process Water System

No process wastewater will be discharged from the plant. The only losses that will occur from the closed-cycle system will be through


QE = 6,400
6,400
UNIT 3
QD=80
QL=20
QD=80
QL=20
UNIT 4
TH=120°F
TH=120°F
3.58 X 10^9
3.58 X 10^9
TC=95°F
QC=290,000
TC=95°F
QC=290,000
QB=11,500
QM=18,000
QM=18,000
QB=11,500
QB=23,000
QM=36,000
QE=4,700
4,700
UNIT 1
QD=80
QL=20
QD=80
QL=20
UNIT 2
TH=120°F
TH=120°F
2.54 X 10^9
0.07 X 10^9
2.61 X 10^9
2.61 X 10^9
0.07 X 10^9
2.54 X 10^9
TC=95°F
QC=210,000
TC=95°F
QC=210,000
QB=8,950
QM=13,750
QM=13,750
QB=8,950
QB=17,900
QM=27,500
QM=63,500
QB=40,900

QB - BLOWDOWN
QC - CIRCULATING WATER
QD - DRIFT
QE - EVAPORATION
QL - MISCELLANEOUS LOSSES
QM - MAKEUP WATER
TC - COLD SIDE
TH - HEAT SIDE

Source: Fluor Pioneer Inc., 1976

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

PLANT COOLING WATER SYSTEM
DAILY MAXIMUM PEAK FLOW (GPM)

FIGURE 4.2.3-4

TABLE 4.2.3-1

EXPECTED AVERAGES FOR DAILY COOLING SYSTEM OPERATION

Month	Capacity Factor (%)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	River Temperature (°F)	Heat Load (10^9 Btu/H)	Cycles of Concentration	Blowdown Temperature (°F)	Evaporation (GPM)	Blowdown (GPM)	Makeup (GPM)	Circulating Water (GPM)
Jan.	62	33.6	30.9	74.2	39	7.26	5	57	8621	1982	10801	656541
Feb.	62	38.5	34.9	71.3	39	7.26	1½[a]	58	9447	18696	28341	656541
Mar.	57	43.8	39.0	67.0	45	6.60	5	68	8840	2012	11050	656541
April	57	57.0	50.0	63.9	53	6.60	5	70	9896	2276	12370	656541
May	57	66.3	59.2	68.5	63	6.60	5	71	10555	2441	13194	656541
June	69	73.6	66.2	70.6	74	8.00	5	85	13274	3022	16593	984812
July	69	77.8	70.0	70.4	78	8.00	5	88	13913	3182	17392	984812
Aug.	69	77.8	69.0	70.1	80	8.00	5	87	13754	3141	17192	984812
Sept.	51	77.3	62.6	68.0	78	5.98	5	77	9939	2287	12424	656541
Oct.	51	57.4	51.5	69.6	69	5.98	5	72	9101	2078	11377	656541
Nov.	51	45.3	40.7	68.5	55	5.98	5	71	8262	1867	10327	656541
Dec.	62	37.3	34.2	72.9	44	7.26	5	58	9303	2128	11629	656541

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[a] In the month of February the suspended solids content of the river is normally extremely high.

Source: Fluor Pioneer Inc., 1977

TABLE 4.2.3-2

ENVIRONMENTAL PROTECTION AGENCY EFFLUENT GUIDELINES AND STANDARDS FOR STEAM ELECTRIC POWER GENERATING 40 CFR 423

Parameter	Discharge Source[a] Low Volume Wastes[b]	Bottom Ash Transport Water[c]	Fly Ash Transport Water	Metal Cleaning Wastes	Boiler Blowdown	Cooling Tower Blowdown	Main Condensers	Area Runoff[d]
Total suspended solids (TSS)								
Daily maximum	100	100	ND[e]	100	100			Not to exceed 50[f]
30-day average	30	30		30	30			
Oil and grease								
Daily maximum	20	20	ND	20	20			
30-day average	15	15		15	15			
Free available chlorine[g]								
Maximum						0.5		
Average						0.2		
Zinc, chromium, phosphorus, and other corrosion inhibitors								
Maximum						NDA[h]		
Average						NDA		
Copper, total								
Daily maximum				1.0	1.0			
30-day average				1.0	1.0			
Iron, total								
Daily maximum				1.0	1.0			
30-day average				1.0	1.0			
pH	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0
Heat							ND[i]	
Polychlorinated biphenyl compounds	ND	ND	ND	ND	ND	ND	ND	ND

Notes

[a] Given in milligrams per liter (mg/l), unless otherwise indicated. The amount of pollutants discharged, unless otherwise indicated, shall not exceed that determined by multiplying the waste source flow times the concentration limit listed for that source. If wastewaters from various sources are combined for discharge, the amount of each pollutant from each source subject to limitation shall not exceed the limit specified for that source.

[b] Low volume wastes are those wastewaters from sources not otherwise specifically identified. These include, but are not limited to, the following sources: wet scrubber air pollution control systems; ion exchange water treatment systems; water treatment evaporator blowdown; laboratory and sampling streams; floor drainage; cooling tower basin cleaning wastes; and blowdown from recirculating house service water systems. Sanitary wastes and air conditioning wastes are specifically not included.

[c] The quantity of pollutants is limited to that defined by multiplying the flow of bottom ash transport water times the limit listed below and dividing the product by 20.

[d] Any untreated overflow from facilities designed, constructed, and operated to treat the volume of material storage runoff and construction runoff that results from a 10-year, 24-hour rainfall event shall not be subject to the TSS and pH limits given below.

[e] ND = no discharge permitted.

TABLE 4.2.3-2 (Continued)

Notes

[f] Remanded and set aside by the U.S. Court of Appeals.

[g] Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than 2 hours in any one day. Not more than one unit in any one plant may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the regional administrator or the state, if the state has NPDES permit issuing authority, that the units in a particular location cannot operate at or below this level of chlorination.

[h] NDA = no detectable amount.

[i] There shall be no discharge of heat from the main condensers except under the following condition: heat may be discharged from recirculated cooling water systems provided the temperature at which the blowdown is discharged does not exceed at any time the lowest temperature of recirculated cooling water prior to the addition of make-up water.

Source: 39 FR 36186, October 8, 1974.

TABLE 4.2.3-3

KENTUCKY (K) WATER QUALITY STANDARDS AND ORSANCO (O) WATER QUALITY CRITERIA BY DESIGNATED USE (MAXIMUM VALUES)[a]

Parameter	KENTUCKY Public Water Supply and Food Processing Industries	KENTUCKY Industrial Water Supply	KENTUCKY Aquatic Life[b]	KENTUCKY Recreation	ORSANCO Public Water Supply and Food Processing Industries	ORSANCO Industrial Water Supply	ORSANCO Aquatic Life[b]	ORSANCO Recreation
Dissolved oxygen			4.0[c]			1.0[d]	4.0[e]	
pH (standard units)		5.0-9.0	6.0-9.0			5.0-9.0	6.8-8.5[f]	
Dissolved solids	500	750			500	750		
Temperature		95°F	g			95°F	g	
Threshold odor number	3				24[h]			
Chloride					250			
Total coliform (per 100 milliliters)	5,000[i]			1,000[j]				
Fecal coliform (per 100 milliliters)				2,000[k]	1,000[l]			200[m]
Arsenic	0.05				0.05			
Barium	1.0				1.0			
Cadmium	0.01				0.01			
Chromium (hexavalent)	0.05				0.05			
Cyanide	0.025				0.025			
Fluoride	1.0				1.0			
Lead	0.05				0.05			
Selenium	0.01				0.01			
Silver	0.05				0.05			

Notes

[a] Units are in milligrams per liter (mg/1) except where otherwise indicated.

[b] Aquatic life standards shall not apply to areas immediately adjacent to outfalls - K, O. These outfalls shall be as small as possible, be provided for mixing only, and shall not prevent the free passage of fish and drift organisms - K.

[c] Average at least 5.0 mg/1 per day and not less than 4.0 mg/1 at any time or place outside the mixing zone.

[d] Not less than 2.0 mg/1 (daily average) nor less than 1.0 mg/1 at any time.

[e] Not less than 4.0 mg/1 at any time and not less than 5.0 mg/1 as a daily average.

[f] Values exceeding 8.5 that are correlated with photosynthetic activity may be tolerated.

[g]

Jan.	50°F	May	80°F	Sept.	87°F
Feb.	50°F	June	87°F	Oct.	78°F
March	60°F	July	89°F	Nov.	70°F
April	70°F	Aug.	89°F	Dec.	57°F

[h] Not to exceed 24 (at 60°C) as daily average.

[i] Not to exceed 5,000/100 ml as monthly mean; nor exceed this value more than 20% of samples/month; nor exceed 20,000/100 ml in more than 5% of such samples.

TABLE 4.2.3-3 (Continued)

Notes

[j] Not to exceed average of 1,000/100 ml and not to exceed this number in 20% of samples/month, nor exceed 2,400/100 ml on any day.

[k] Not to exceed an average of 2,000/100 ml nor a maximum of 4,000/100 ml.

[l] Not to exceed 1,000/100 ml as a monthly average; nor exceed this value in more than 20% of samples/month, nor exceed 4,000/100 ml in more than 5% of samples/month.

[m] Not to exceed 200/100 ml as monthly geometric mean, nor to exceed 400/100 ml in more than 10% of samples/month.

Sources: Commonwealth of Kentucky, Department for Natural Resources and Environmental Protection, Division of Water Quality, Water Quality Standards for Waters of the Commonwealth of Kentucky, 401 KAR 5:025, June 5, 1975.

Ohio River Valley Water Sanitation Commission, ORSANCO Stream Quality and Minimum Conditions, May 15, 1970.

TABLE 4.2.3-4

WATER TREATMENT CHEMICAL USAGE (2,340 MW NET)
TRIMBLE COUNTY GENERATING PLANT

Name	Formula	Grade	Density	Use	Amount/Year
Sulfuric Acid	H_2SO_4	66° Be	15.3 lb/gal	Circulating Water Demineralizers	7,000,000 lb 880,000 lb
Sodium Hypochlorite	$Na\ O\ Cl$	15%	9.3 lb/gal	Circulating Water Potable Water Sanitary Waste	1,840,000 gal 150 gal 150 gal
Sodium Hydroxide	$Na\ OH$	50%	11.4 lb/gal	Demineralizers	300,000 lb
Lime	$Ca\ O$	90%	53-62 lb/ft^3	pH Adjustment Clarification	700,000 lb
Hydrazine	$NH_2\ NH_2$	1.011 sp. gr.	8.43 lb/gal	Boiler Water	
Morpholine	$OCH_2CH_2NHCH_2CH_2$	0.9998 sp. gr.	8.34 lb/gal	Boiler Water	
Sodium Chloride	$NaCl$	98%	50-70 lb/ft^3	Potable Water Softener	32,000 lb

TABLE 4.2.3-5

COOLING TOWER BLOWDOWN CHARACTERISTICS TRIMBLE COUNTY GENERATING PLANT[a]

Parameter	Untreated Makeup Water	Cooling Tower Blowdown		
	Daily Average	Minimum	Daily Average	Maximum
Flow (10^6 gallons/day)	57	23	35	41
pH (standard units)	7.5	6	-	9
Winter Temperature (°F)	40	50	62	87
Summer Temperature (°F)	80	70	84	108
Biochemical Oxygen Demand (mg/l)	3	4	6	14
Chemical Oxygen Demand (mg/l)	13	20	26	66
Total Suspended Solids (nonfilterable)	117	176	234	585
Specific Conductance (µmhos/cm at 25°C)	227	340	-	1,133
Calcium (Ca)	43	65	87	217
Magnesium (Mg)	10	15	20	50
Sodium (Na)	15	23	31	77
Potassium (K)	3	4	6	15
Alkalinity ($CaCO_3$)	65	0	130	130
Chloride (Cl)	36	55	73	183
Sulfate (SO_4)	69	104	160	630
Phosphate (PO_4)	0.8	1.2	1.6	4.0
Silica (SiO_2)	5	7.2	9.6	24.1
Chlorine	-	0	0.2	0.5

Note: 1.8 lb chlorine per million gallons of recirculated water and 7.01b of sulfuric acid per million gallons of recirculated water will be added to circulating water system. Amount of sulfuric acid could vary from 0 to 14.6 lb per million gallons, depending on river water quality and number of cycles of concentration.

---

[a] Values in milligrams per liter unless otherwise indicated.

evaporation and system losses. Water from the solid waste process plant and boiler blowdown; demineralizer, neutralizer, and ash sluicing system and overflow water; water from floor drains; and cleaning and miscellaneous wastewater will be transferred to the bottom ash compartment of the onsite disposal pond. After settling has occurred, water will be drawn from this pond and used as makeup for the process water system.

Water treatment for plant process water is defined in Table 4.2.3-4.

Sanitary Facilities and Waste Treatment

Treatment for domestic wastewater will be provided by three extended aeration process sewage treatment plants. Two of the plants will have a capacity of 6,000 gpd each; the other will be a 10,500-gpd unit. Chlorine will be added as a final treatment (see Table 4.2.3-4). Until construction of the onsite disposal pond is complete, the effluent from the two smaller plants will be discharged into the sediment retention basin. After the onsite disposal pond is placed in service, the larger sewage treatment plant will be installed. The effluent from all three plants will then be pumped to the bottom ash compartment of the pond for final disposal.

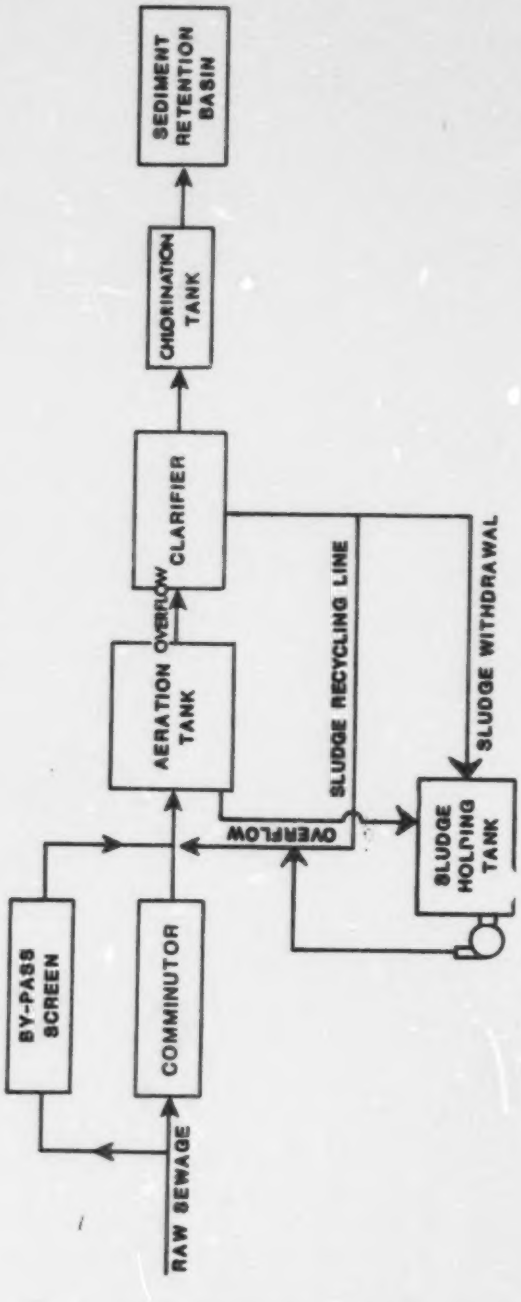
The first 6,000-gpd plant will be installed in October 1978 and will be removed in 1990. The second 6,000-gpd plant will be installed in 1980 and will be removed in late 1991. The 10,500-gpd plant will be installed in 1983 and will remain in service for the life of the plant. This unit is designed to serve the generating plant operating personnel. Figure 4.2.3-5 is a diagram of the proposed waste treatment system.

4.2.4 Flue Gas Treatment System

It is planned that the steam generators of the proposed plant will fire western Kentucky coal. The coal may be used raw or washed. The heating value of the raw coal is expected to be between 10,000 and 10,650 Btu/lb. The preliminary coal analysis (contents as received) is presented below:

Moisture	9.46%
Ash	16.93%
Volatile	29.99%
Fixed Carbon	43.62%
	100.00%
Btu/lb	10,455
Sulfur	4.29%

As the products of combustion leave the steam generator, they are routed to an air preheater where the flue gas gives up much of its heat. Some air leakage to the flue gas occurs, usually about 10 percent. It is anticipated that the temperature of flue gas as it exits from the air preheater will be approximately 300°F.


RAW SEWAGE
BY-PASS SCREEN
COMMINUTOR
AERATION TANK
OVERFLOW
CLARIFIER
CHLORINATION TANK
SEDIMENT RETENTION BASIN
SLUDGE RECYCLING LINE
SLUDGE WITHDRAWAL
OVERFLOW
SLUDGE HOLDING TANK

EXTENDED AERATION PROCESS

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

PROPOSED WASTE
TREATMENT SYSTEM

FIGURE 4.2.3-5

The composition of the flue gas at the boiler exit is expected to be as depicted in Table 4.2.4-1. For a schematic diagram of the flue gas treatment system, see Figure 4.2.4-1.

Three flue gas control goals determine the system:

1. a process in the boiler for nitrogen oxide (NO_x) reduction;

2. electrostatic precipitators for particulate removal; and

3. scrubbers for SO_2 removal.

Control of NO_x emissions will be built into the boiler design. The particular method of control will be determined by the manufacturer. Basically, there are three methods of reducing NO_x emissions in a boiler: (1) by water or steam injection; (2) by flue gas recirculation; and (3) by over-fire air, also known as two-stage combustion. These methods depend on the particular boiler vendor.

The precipitators will operate at 99.6 percent efficiency, removing about 297,106 lb/hr of fly ash. The remaining 1,194 lb/hr (all four units) will leave the precipitators entrained in the flue gas.

Flue gases leaving the precipitators are directed to a wet scrubbing system. The basis for an adequate sulfur dioxide system for all four units proposed at the Trimble County Generating Plant is that such a system must have a sulfur dioxide removal efficiency of 90 percent. The 90 percent scrubber efficiency rate was modeled, and it was determined that the federal maximum allowable increments of significant deterioration would be met with the scrubbers operating at this efficiency. Thus, only the types of processes which reliably meet this 90 percent criterion will be considered for use at the proposed facility.

Over the recent history of SO_2 removal process development, specifically during the past few years, a number of processes have been developed which reliably operate on large installations throughout the world. The greatest degree of success has been registered by installations in Japan. In this country, considerable success has been noted recently on various processes which meet the 90 percent requirement. These processes are:

1. The straight use of sodium hydroxide; this general type is known as the Wellman-Lord Approach

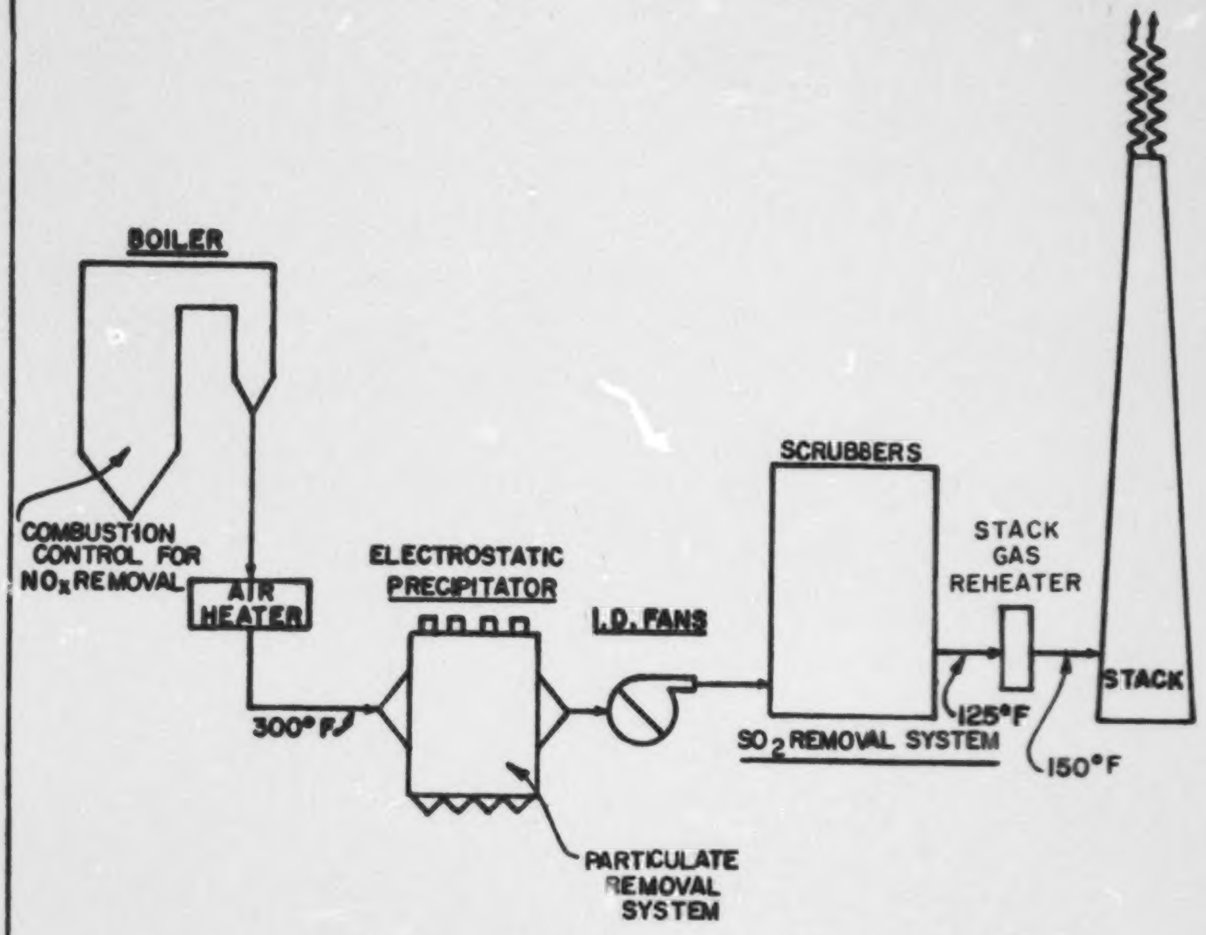
2. The overall straight lime approach, which produces calcium sulfite and calcium sulfate sludges. The degree of oxidation used in the various processes determines the ratio of $CaSO_3$ and $CaSO_4$.

3. The Chiyoda-Thoroughbred Process, which circulates a dilute solution of sulfuric acid. The acid reacts to form higher percentages of H_2SO_4, which in turn is removed later in the process by a neutralization with limestone to form a high percentage conversion to gypsum

TABLE 4.2.4-1

FLUE GAS COMPOSITION AT BOILER EXIT
TRIMBLE COUNTY GENERATING PLANT

Composition	Unit 1 (lb/hr)	Unit 2 (lb/hr)	Unit 3 (lb/hr)	Unit 4 (lb/hr)	Total (lb/hr)
CO_2	1,013,352	1,013,352	1,381,837	1,381,837	4,790,378
NO_2	2,965,354	2,965,354	4,043,660	4,043,660	14,018,028
SO_2	39,903	39,903	54,413	54,413	188,632
Excess Air	808,928	808,928	1,103,082	1,103,082	3,824,020
Air Leakage	517,885	517,885	706,206	706,206	2,448,182
Total Moisture	285,865	285,865	389,815	389,815	1,351,361
Ash	66,956	66,956	91,303	91,303	316,519
Total Flue Gas Entering Precipitator	5,698,243	5,698,243	7,770,316	7,770,316	26,937,120


BOILER
COMBUSTION CONTROL FOR NO_x REMOVAL
AIR HEATER
300° F.
ELECTROSTATIC PRECIPITATOR
PARTICULATE REMOVAL SYSTEM
I.D. FANS
SCRUBBERS
SO_2 REMOVAL SYSTEM
125°F
STACK GAS REHEATER
150°F
STACK

DATE	FLUOR PIONEER INC.	STANDARD DETAIL
	STACK EMISSION SYSTEM	SHT OF FIG. 4.2.4-1

FORM C-312 10/74

4. The straight use of MgO, generally known as the Magnesium Process, which converts MgO to $MgSO_3$ and then, through a very expensive handling process, to H_2SO_4

5. The straight use of limestone, which has been basically successful now that a better control and understanding of the sulfur dioxide chemistry exists

6. The general category known as the Dual-Alkali Approach, which circulates sodium salts to remove SO_2 in the various types of scrubbers. The reacted solution is then removed from the scrubber and processed through various procedures to convert the sodium salts to $CaSO_3$ and $CaSO_4$. The processes in most cases use $Ca(OH)_2$. The overall removal efficiencies, on all installations developed, approach a range of 95 to 99 percent

7. The general category of regenerable processes, which tend to be rather expensive in their execution

The Applicant favors a limestone-based system due to economic considerations and because of water and waste disposal requirements. Limestone has a cost advantage over lime and, in addition, the use of limestone conserves energy, because the large amounts of energy required to process limestone into lime are avoided.

Scrubbers operating at 90 percent efficiency will remove 34,038 lb/hr of SO_2 from Unit 1 (same for Unit 2), leaving not more than 3,780 lb/hr still entrained in the wet flue gas. The scrubber on Unit 3 (same for Unit 4) will remove 46,422 lb/hr of SO_2, leaving not more than 5,160 lb/hr entrained in the wet flue gas.

The waste sludge from the scrubbers will be processed to a stabilized fill and disposed of in nearsite ravines.

Due to the interaction of the wet reactant slurry and the wet flue gas in the scrubber, three other coincidental occurrences take place that affect the flue gas composition:

1. Some additional fly ash removal is effected. Credit for this removal has not been taken into account in the computations of effluents because the amount of fly ash in flue gas entering the SO_2 scrubber is minimal. Scrubber manufacturers do not design their equipment specifically for fly ash removal because of the small amount being handled

2. Additional water vapor from the slurry is added to the flue gas. This additional moisture is estimated to be 221,950 lb/hr, resulting in a moisture content of 507,815 lb/hr in the flue gas leaving the scrubber

3. A small amount of NO_x will be removed by the wet scrubbers. No estimate of the amount removed can be made at this time, because the scrubber manufacturer has not been selected

After leaving the scrubber, flue gases are routed to the chimney for disposal. The composition of the flue gas leaving each of the scrubbers at 150°F and entering the chimney for Units 1 through 4 is expected to be as shown in Table 4.2.4-2.

The plant elevation will be approximately 475 feet above sea level. The bluffs on both sides of the Ohio River are approximately 760 feet above sea level. Preliminary studies indicate that a 760-foot-high chimney will be required for the flue gases to adequately rise above these bluffs. A model study was used to determine the actual chimney heights needed.

The expected quantities and characteristics of atmospheric emissions are described in Section 4.2.9.

The environmental impacts resulting from the flue gas emissions are described in Sections 6.3.1 and 6.4.1.

Alternative flue gas treatment systems have been described in Section 3.4.2.

4.2.5 Plant Solid Waste System

Types of Solid Waste Produced

Solid wastes produced by a coal-fired generating plant like the one proposed are ash from coal and waste from the SO_2 scrubber.

Ash is a nonburnable component of coal and has two basic forms: bottom ash and fly ash. Bottom ash is the larger of the two particulates. It is called bottom ash because, during the combustion process, it falls to the bottom of the boiler furnaces. Fly ash, a very fine particulate material, is so called because it is carried from the boiler by the exhaust (flue) gases.

Scrubber waste solids are precipitated by the reaction of limestone slurries in the scrubber with the SO_2 in the flue gases.

Additionally, minor quantities of pyrites (metallic sulfides), mill rejects (pulverized rejects from the mills), and water treatment waste solids comprise part of the solid waste generated by the plant. Water treatment solids are precipitated by chemical reaction or clarification as the circulating water is processed for use in the plant.

In the calculations of quantities and volumes of solid waste produced by the plant, water treatment wastes are tabulated as a separate item. However, in the discussion of the solid waste handling and disposal process, these solids are included under the term scrubber solid wastes.

TABLE 4.2.4-2

FLUE GAS COMPOSITION AT SCRUBBER EXIT
TRIMBLE COUNTY GENERATING PLANT

Composition	Unit 1 (lb/hr)	Unit 2 (lb/hr)	Unit 3 (lb/hr)	Unit 4 (lb/hr)	Total (lb/hr)
CO_2	1,013,352	1,013,352	1,381,842	1,381,842	4,790,388
NO_2	2,965,354	2,965,354	4,043,660	4,043,660	14,018,028
SO_2	3,985	3,985	5,436	5,436	18,842
Air	1,326,813	1,326,813	1,809,288	1,809,288	6,272,202
Moisture	507,815	507,815	692,474	692,474	2,400,578
Ash Particulates	268	268	365	365	1,266
Total Gas Leaving the Scrubber	5,817,587	5,817,587	7,933,065	7,933,065	27,501,304

Quantities of Solid Waste Produced

The amounts of sludge, fly ash, and bottom ash (including pyrites and mill rejects) that will be produced by the proposed plant are a function of plant operation and materials parameters. The approximate quantity of each type of solid waste was calculated on the basis of the parameters in Technical Appendix III, and the amounts are presented in Technical Appendix IV. Section 3.4.5 contains a discussion of the way these parameters affect the total amount of solid waste produced by the plant.

Solid Waste Handling Technology

The technology for ash disposal is well defined and has been used in the utility industry for many years. Ponding and landfill are the basic methods for ash disposal.

The Applicant's approach to scrubber solid waste disposal involves chemical fixation of the waste that will convert it into a chemically and physically stable landfill material (see Section 3.4.5). Approximately 50 percent by weight dewatered sludge will be mixed with fly ash, and a chemical fixation agent (limestone) will be added to the mixture to produce the final landfill material.

The proposed handling, treatment, and disposal schemes for bottom ash, fly ash, and scrubber sludge are described in the following paragraphs.

Bottom Ash

Bottom ash will be collected in a multi-compartmented, water-impounded, gravity-discharge-type hopper located directly below the steam generator. The ash will be cooled on contact with water in the hopper, then flushed from the hopper as an ash-water slurry. This slurry will first be sent through crushers or grinders to assure correct particle size, then transferred via jet pump to the bottom ash compartment of the onsite disposal pond. Water used to convey the bottom ash, plus any rainwater that collects in the pond, will be decanted and recycled.

Pyrites and Mill Rejects

Pyrites and mill rejects will be collected in a hopper like the one used to collect bottom ash. A jet pump will then discharge the rejects to a storage tank. After bottom ash removal is complete, the storage tank will be unloaded to the ash jet pump section and the contents discharged to the bottom ash pond.

Fly Ash

Fly ash will be collected by hoppers at the economizer, the air heaters, and the electrostatic precipitators. All fly ash will be conveyed pneumatically in a dry state from the associated hoppers to the fly ash storage silos, which can accommodate 3 days' peak production of fly ash. From the silos, the fly ash will be conveyed by a pneumatic pressure system to the fly ash transfer bin of the process plant. From this bin the fly ash will be conveyed dry to a pug mill for mixing with the scrubber solids and a chemical fixation agent. A set of bag filter dust collectors will be provided at each fly ash silo to separate fly ash from the conveying air, or the air will be returned to the precipitator.

Scrubber Waste

Scrubber waste is formed by the wet scrubbing process that takes place in the SO_2 scrubber units. For the 495-MWe and 675-MWe units, the scrubber is expected to produce 1,200 tons/day and 1,600 tons/day, respectively, of limestone sludge on a dry basis from the worst grade coal at the maximim daily capacity factor (80 percent).

Bleed-off sludge liquor from the recycle tank scrubber return line will be pumped to a clarifier or thickener tank. Underflow from the tank at approximately 20 percent solids will then be pumped to a holdup pond, located near the process plant, which will have a 3-day storage capacity. Overflow from the clarifier or thickener will be recycled to the spray tower.

From the holdup pond, sludge will be pumped to a sludge transfer tank for subsequent feed into a vacuum filter, centrifuge, or pressure filter. The resulting filter cake will be transferred to a pug mill for mixing with dry fly ash and a fixation agent. The final resulting mixture will then be conveyed mechanically to Ravines RA and RB.

In the event that the process plant is inoperable, disposal for the fly ash and scrubber sludge will be provided in the fly ash/sludge compartment of the onsite disposal pond (see Section 3.4.5).

Solid Waste Disposal Areas

The available solid waste disposal areas are identified as onsite and nearsite for the purpose of this report. Their locations are as follows: onsite--at the north boundary of the site, covering 270 acres; nearsite--at two ravines, designated RA (660 acres) and RB (780 acres), which are adjacent to, and to the northeast of, the site (see Figure 4.2.5-1). A detailed description of the proposed scheme for developing the disposal ravines and the onsite pond is provided in Section 3.4.5. The volume of waste estimated to be disposed in these two areas is presented in Table 4.2.5-1.

4.2.6 Dock Facilities

Dock facilities will be required for barges delivering coal, limestone, fuel oil and chemicals, equipment, and other materials. A small building for storing tools and miscellaneous equipment will be located on each dock. The barge unloading facilities are indicated on Figure 4.1-1, Site Layout, and the separate unloading facilities are described in the following paragraphs.

Coal Barge Unloading Dock

The coal barge dock will be located offshore of the east bank of the Ohio River at River Mile 571.5. The unloading facility will consist of a cluster of approximately four cells (35 to 40 feet in diameter) located in the river. These cells will support a continuous bucket ladder unloader, conveyor, and access roadway to shore.

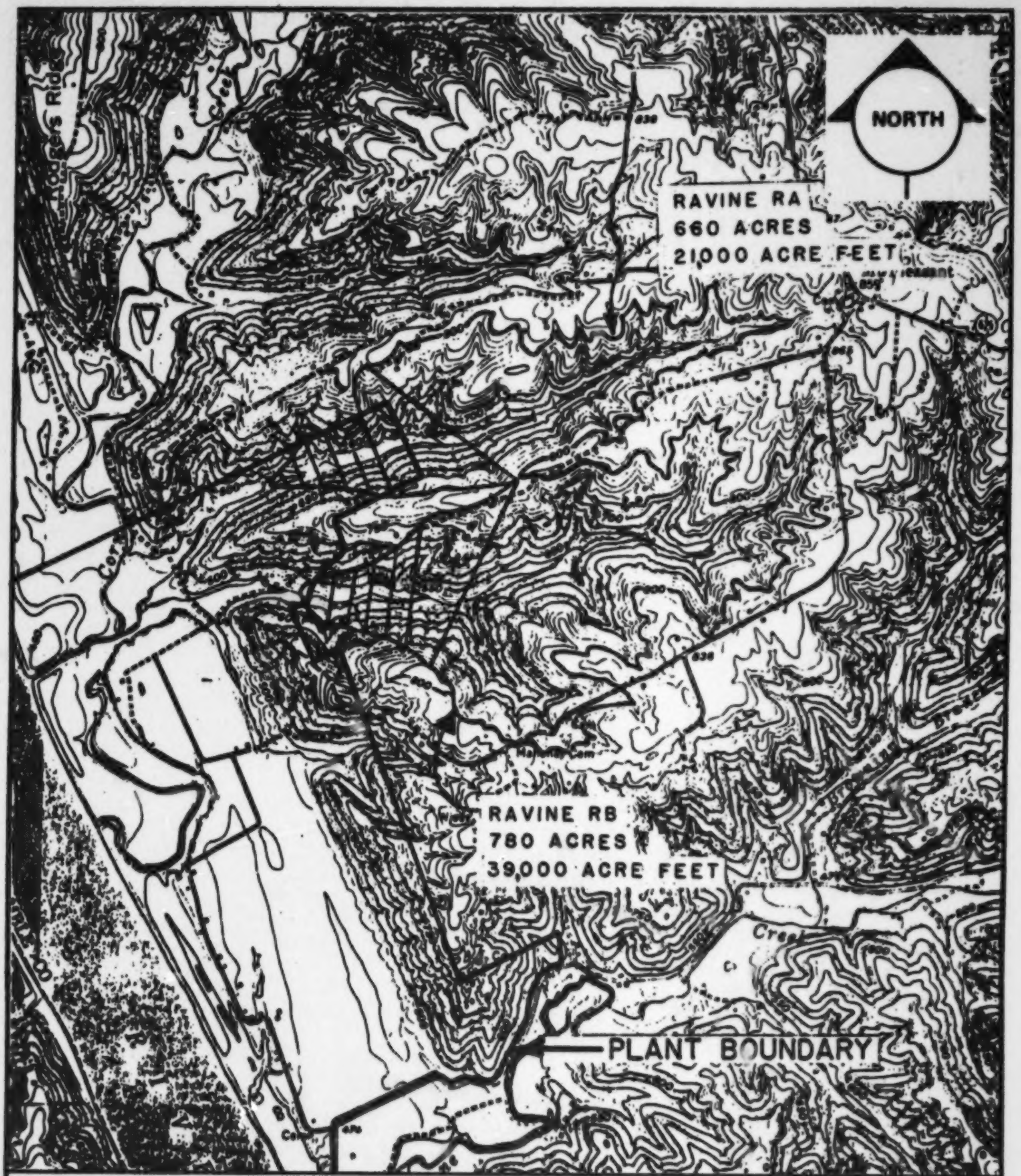
Immediately upstream a row of cells will be provided for mooring full barges. Downstream, a row of cells will be provided for mooring empty barges. The diameter of these cells will be approximately 20 to 25 feet.

The facility will be sized to unload five barge tows (15 barges) per week. The unloading will be accomplished in two shifts during daylight hours, 7 days per week, 50 weeks per year. Each tow will deliver approximately 22,500 tons of coal. The unloader will have an average digging capacity of approximately 3,000 tons per hour.

The total length of the coal dock facility will be approximately 3,150 feet. However, only approximately 50 feet of the natural river shoreline habitat will be appropriated for the access bridge. The mooring cells will be parallel to the shoreline. For full barges the cells will be set 250 feet offshore; for empty barges, 180 feet. This arrangement will allow the barge draft requirements (12 feet for full barges; 2 feet for empty) to be met without dredging, which would be required if the barges were to be moored closer to shore.

The position of the mooring cells and barge rafts (three strings of five barges each) relative to the center line of the navigation channel (sailing line) of the river is shown on Figure 4.1-1. An additional barge raft could be moored alongside the one shown in Figure 4.1-1; this would extend the total width of the facility another 105 feet into the river.

The closest distance from a mooring cell to the center line of the navigation channel will be approximately 1,100 feet. With two barge rafts docked side by side, the clearance to the center of the channel will be approximately 900 feet. Navigation lights to minimize hazards to commercial navigation will be provided at the 475-foot top elevation of the mooring cells.


NORTH
RAVINE RA
660 ACRES
21,000 ACRE FEET
RAVINE RB
780 ACRES
39,000 ACRE FEET
PLANT BOUNDARY

Designed By
FLUOR PIONEER INC.
CHICAGO, ILLINOIS 60606

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY PLANT SITE

SOLID WASTE DISPOSAL AREA

DRAWN		CHECKED		DGL		APPROVED	SCALE-1"=2000'
A.R.	11-7-75			R.W.L	11-7-75		PROJECT NO. 317296
A	B	C	D	E	F		Figure 4.2.5-1

TABLE 4.2.5-1

ESTIMATED VOLUMES OF ASH AND SLUDGE PRODUCED AT THE TRIMBLE COUNTY GENERATING PLANT (2,340 MWe) USING WET LIME/LIMESTONE SCRUBBING WITH ALSTON #1 RAW COAL

Type of Waste	Quantity Produced/Year[a] (Acre-Feet)		Total Quantity Produced (Acre-Feet)	
	Years 1-20[b]	Years 21-30[c]	Years 1-20[b]	Years 21-30[c]
Chemically Fixed:				
Limestone sludge + ash + chemical fixation agent + water treatment solids (ρ = 75 lbs/ft^3)[d]	2,430	1,000	48,600	58,600
Bottom ash (80% solids)	289[e]	96[e]	–	–

---

[a] Time measured from start up of Trimble County Unit #4.

[b] Average capacity factor = 60%.

[c] Average capacity factor = 25%.

[d] ρ = density.

[e] Stored separately so that factor of 1.5 is introduced (i.e., 30%/20%).

Lighting for possible nighttime operation of the coal barge unloading facility will consist of area-type lighting with a minimum illumination level of 0.5 foot-candle. Walkways and work areas will be illuminated with a minimum level of 2 foot-candles. The location of the coal dock facility at the northern end of the site area will minimize the impact of night lighting, as well as noise, on the residential area of Wises Landing to the south.

A wet-type dust suppression system will be used to minimize dust from the coal barge unloading operations. No liquid waste will result.

Dry Reactant, Fuel Oil, and Chemicals Unloading Dock

A tentative choice of limestone as the SO_2 scrubber reactant has been made (see Section 3.4.2). A clamshell type unloader will be used to unload approximately 17 barges of limestone per week.

The docking facility for unloading limestone, fuel oil, and chemicals will be located as shown on Figure 4.1-1. The facility, including mooring cells, will extend approximately 1,790 feet along the shoreline. The majority of the construction will take place offshore. The dry reactant will arrive on a tow of barges that would be tied to a row of seven mooring cells located 200 feet offshore (elevation 420 feet shoreline) spaced approximately 195 feet on center. The unloading equipment will be supported on a cluster of mooring cells with a bridge access from the land side. Empty barges will be assembled along mooring cells located 120 feet offshore and spaced approximately 195 feet on center. The tops of the mooring cells will be at elevation 475 feet. Diameter of the mooring cells will be approximately 20 to 25 feet. The outermost projection from the shoreline of a moored barge will be 300 feet. The closest distance from a mooring cell to the center line of the navigation channel will be approximately 1,200 feet. The distance from the outermost barge to the center line of the navigation channel will be approximately 1,085 feet.

The distance from shoreline to the outer side of a barge will be 155 feet. The clearance between the mooring cells and the center of the navigation channel will be approximately 1,200 feet. Water depth at the cells will be 12 feet at normal pool elevation. The cells will be provided with navigation warnings, as required.

This facility will also handle annual deliveries of seven 10,000-barrel barges of fuel oil for start up and flame stabilization; three 1,500-ton barges of caustic soda; two barges of sulfuric acid; and nine barges of alum for clarification and water softening. Alternative delivery by truck would require approximately 1,718 trucks of 8,000-gallon capacity per year for oil; 69 trucks for caustic soda; 36 trucks for sulfuric acid; and 207 trucks for alum.

The facility will be designed to unload single barges by means of pumps mounted on the delivery barges. Flexible discharge lines will connect the pumps to pipes that will cross over to shore on the limestone conveyor bridge. Equipment will be provided in compliance with Kentucky Air Pollution Control Regulation 401 KAR 3:050, Section 20, which requires vapor collection for 90 percent reduction by weight for liquid hydrocarbon unloading.

Spill control for oil will be provided by positioning a floating boom around the barge unloading facility. An oil skimmer mounted on a motorized work barge would remove any contained spills from the river. The oil-water mixture would be stored temporarily in the work barge prior to ultimate disposal.

Equipment Unloading Dock

The equipment unloading dock will be located downstream of the liquid and chemicals unloading facility, at River Mile 572.0. This facility will consist of a 220-foot by 150-foot structural concrete slab supported by a combination of cells and backfill. The top of the slab will be at elevation 444 feet. Mounted on top of the structural slab will be a 750-ton capacity crane. Access from the unloading area to the plant site will be by roadway.

The top of the cells will be at elevation 444 feet. Navigation warning lights will be mounted on poles extending above the cells to elevation 475 feet to mark cell location during high water. The dock facility will extend 78 feet into the Ohio River.

4.2.7 Fuel Handling System

Coal will be the fuel for the main boilers of the proposed Trimble County Generating Plant. Number 2 fuel oil will be used for boiler ignition and flame control during start-up and at low loads. Both the coal and the fuel oil will be delivered by river barges. These fuels will be received at the plant dock facilities and stored onsite.

Coal Handling

Coal will be delivered to the plant by unitized barge tows. A coal handling system will be provided for continuous and automatic conveying of coal from the barge unloader to the silos in the main plant. Coal will be moved from the barge unloader by belt conveyor to the sample house and from there to the stacking-reclaiming machine. Stacking equipment will then move the coal to the active coal pile. A portion of the coal in the active pile will be moved by dozer to an inactive pile, which will hold in reserve a 90-day supply of coal (approximately 1,400,000 tons).

Normally, coal will be reclaimed from the active pile by the reclaiming equipment and conveyed to the crusher house. However, coal can also be taken from the inactive pile by dozing it into the inactive reclaim hopper and conveying it to the crusher house by this means. From the crusher house, the coal will be conveyed to the silos in the main plant, where it will be stored prior to being pulverized and fed to the boilers.

The coal handling system will be sized to satisfy the requirements of the four units. A diagram of the coal handling system is provided on Figure 4.2.7-1.

The effects of the coal handling system are discussed in Section 6.0, and measures to mitigate the impacts are discussed in Section 7.0.

Fuel Oil

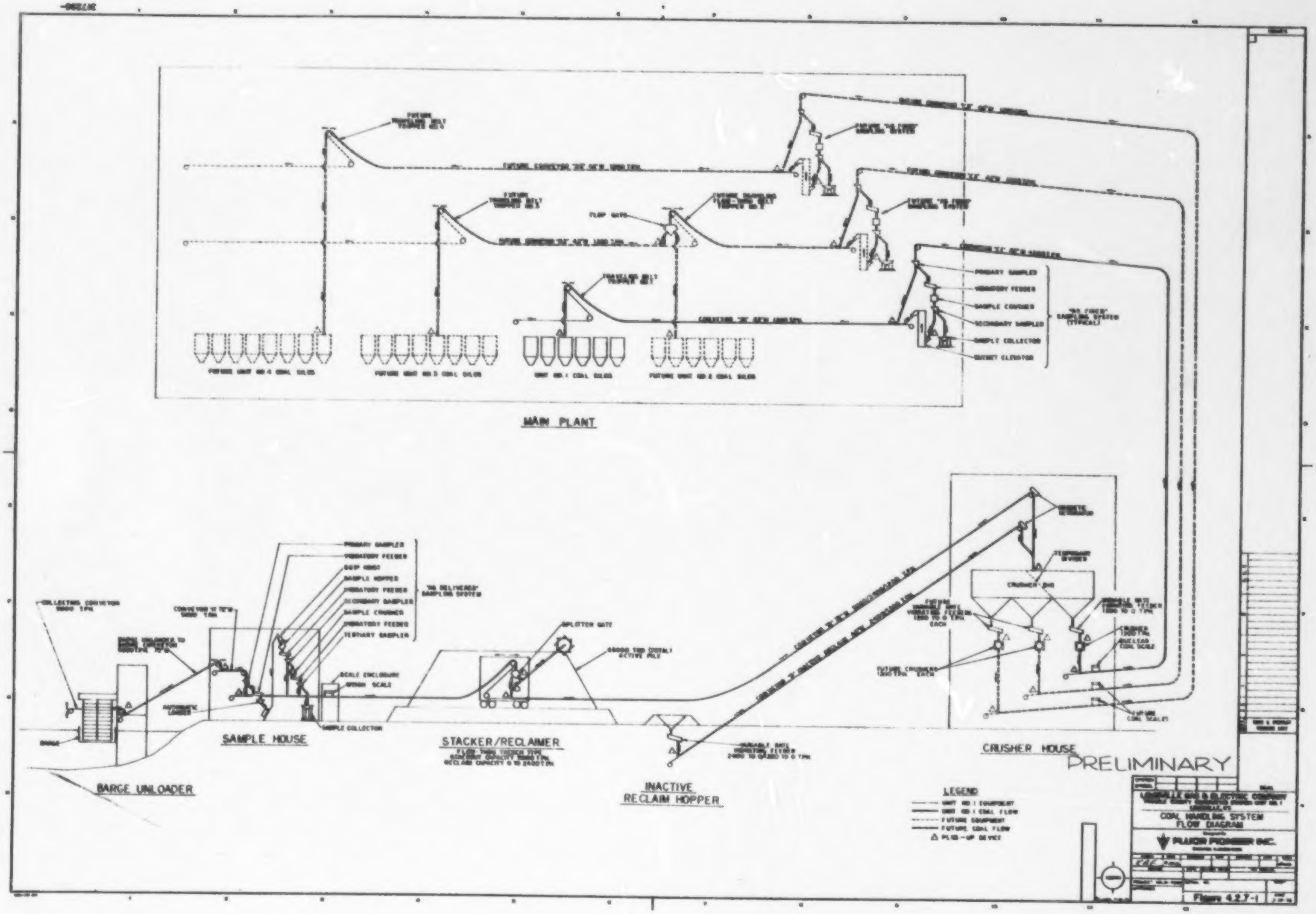
Number 2 fuel oil will be delivered by barge and will be pumped from the unloading facilities into storage tanks. The diked storage tank area will be lined with an impervious material. The tanks will be equipped with floating roofs, vapor conservation vents, and flame arresters. The tanks and diking will be constructed in accordance with American Petroleum Institute standards. The dikes will be sized to contain at least 110 percent of the capacity of the largest tank and will be provided with concrete sumps. Any water collected in the sumps will be pumped to an oil separator for recovery of oil.

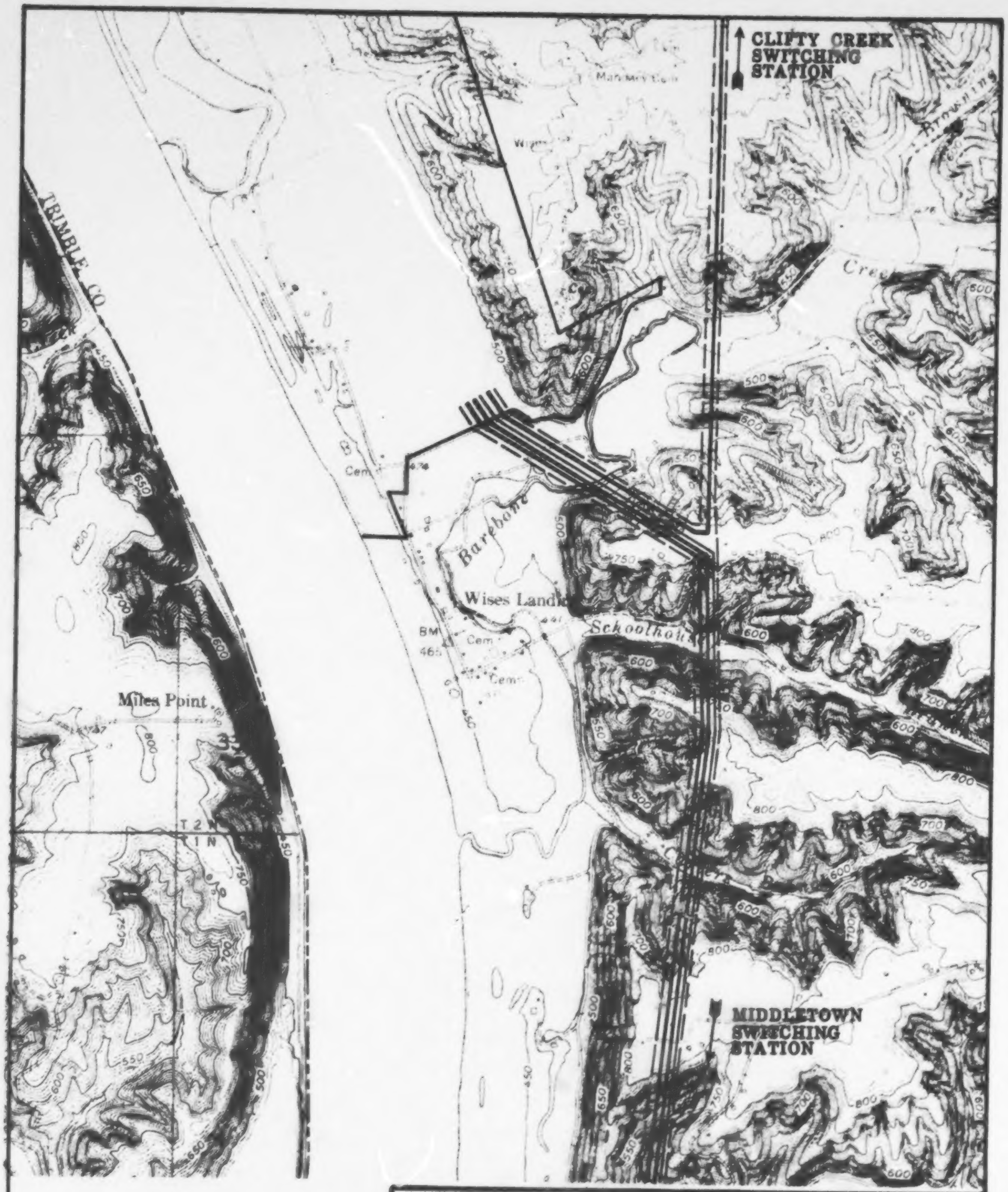
4.2.8 Transmission Facilities

A total of three 345-kV transmission line circuits, plus one back-up circuit, will be required to integrate the ultimate generating capacity of the Trimble County Generating Plant into the Applicant's system. The transmission system will be part of a 345-kV system loop. This loop, part of which is already either in service or under construction, will consist of two circuits connecting the Trimble County Generating Plant with the Applicant's Middletown Switching Station and two circuits connecting the Trimble County Generating Plant with the Company's Northside Switching Station, which is north of Jeffersonville, Indiana.

At present, a 345-kV transmission line connects the Clifty Creek (OVEC) and Middletown (Applicant's) switching stations. This line passes less than 1 mile east of the proposed Trimble County Generating Plant site. At the time it was built, this line was unrelated to the proposed Trimble County project. Through modification, however, the line will be integrated into the project, thus negating the necessity to construct a transmission facility for the project. When the proposed Trimble County Generating Plant is constructed, this 345-kV line will be interrupted at a point east of the plant site, and both legs of the line will be brought into the new Trimble County Generating Plant switching station (see Figure 4.2.8-1). One leg will then connect the Clifty Creek Switching Station to the Applicant's system through the Trimble County Switching Station, while the other leg will connect the Trimble County Switching Station with the Applicant's Middletown Substation.

When Unit 2 of the Trimble County Plant goes in service, a new transmission line will be built through Indiana. A section of this line approximately 9 miles long will be constructed from the plant along a new right-of-way in Clark County, Indiana, with a terminus point on an existing right-of-way belonging to the Applicant. The exact direction that this right-of-way will take has not been determined. One preliminary transmission line corridor, a straight line from the plant to the tie-in right-of-way, has been suggested (see Section 5.8.2 and Figure 5.2.3-2). This line is addressed in this report. Figure 4.2.8-2 is a diagram of the proposed river crossing.

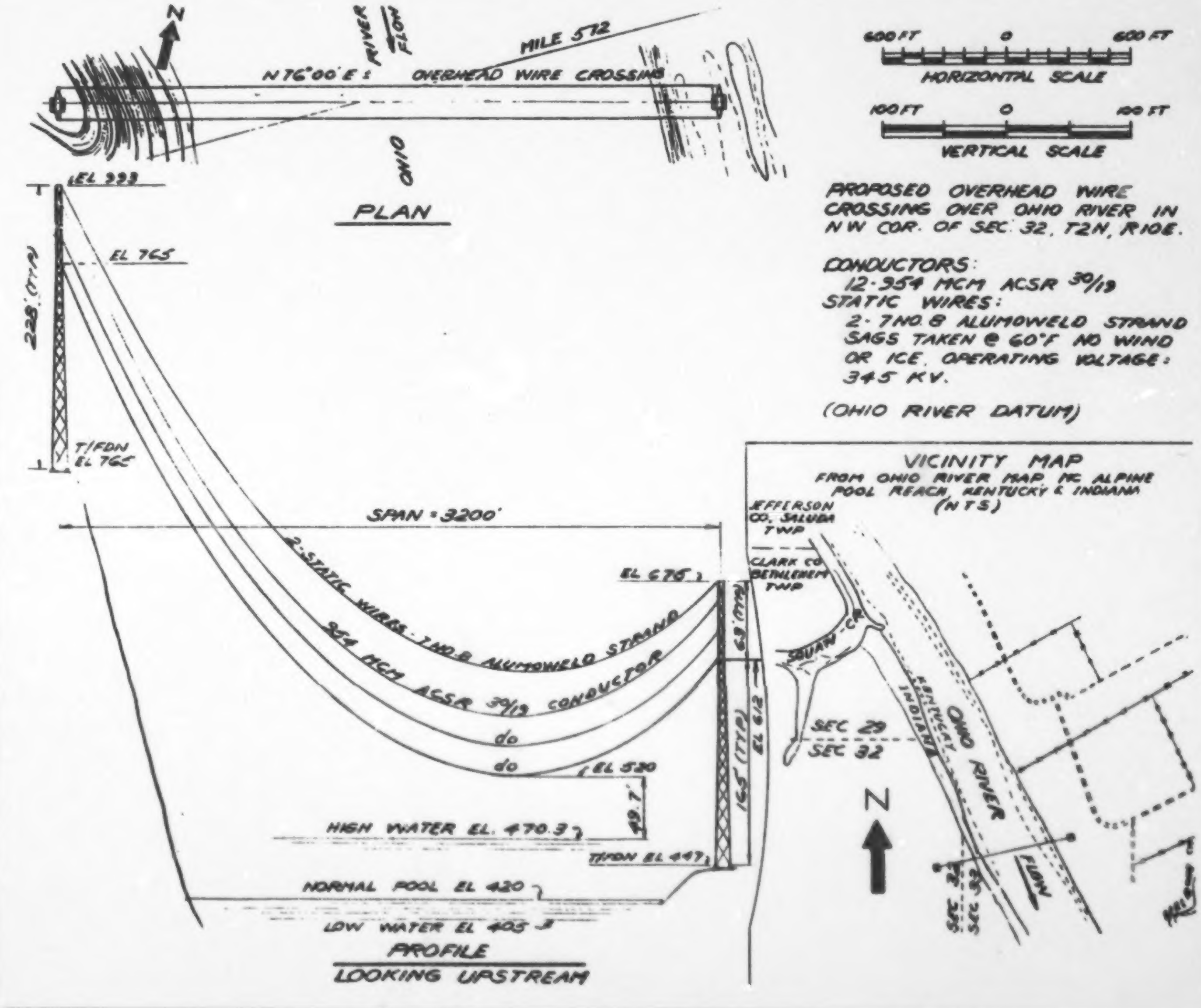

MAIN PLANT
FUTURE UNIT NO 4 COAL SILOS
FUTURE UNIT NO 3 COAL SILOS
UNIT NO 1 COAL SILOS
FUTURE UNIT NO 2 COAL SILOS
FLOP GATE
PRIMARY SAMPLER
VIBRATORY FEEDER
SAMPLE CRUSHER
SECONDARY SAMPLER
SAMPLE COLLECTOR
BUCKET ELEVATOR
"AS FIRED" SAMPLING SYSTEM (TYPICAL)
BARGE UNLOADER
BARGE
SAMPLE HOUSE
PRIMARY SAMPLER
VIBRATORY FEEDER
DEEP HOIST
SAMPLE HOPPER
VIBRATORY FEEDER
SECONDARY SAMPLER
SAMPLE CRUSHER
VIBRATORY FEEDER
TERTIARY SAMPLER
"AS DELIVERED" SAMPLING SYSTEM
SCALE ENCLOSURE
WEIGH SCALE
SAMPLE COLLECTOR
STACKER/RECLAIMER
SPLITTER GATE
ACTIVE PILE
INACTIVE
RECLAIM HOPPER
CRUSHER HOUSE
CRUSHER BIN
PRELIMINARY
LEGEND
Δ PLUG-UP DEVICE
COAL HANDLING SYSTEM
FLOW DIAGRAM
FLUOR PIONEER INC.
Figure 4.2.7-1


CLIFTY CREEK
SWITCHING
STATION
MIDDLETOWN
SWITCHING
STATION
TRIMBLE CO
Barebone
Wises Landing
Schoolhouse
Milea Point
Creek
Cem
BM
465
T 2 W
T 1 N
-N-
0
2000
4000
SCALE IN FEET

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

KENTUCKY TRANSMISSION
LINE CORRIDOR

FIGURE 4.2.8-1


N
RIVER FLOW
MILE 572
N 76°00' E ± OVERHEAD WIRE CROSSING
OHIO
PLAN
600 FT
0
600 FT
HORIZONTAL SCALE
100 FT
0
100 FT
VERTICAL SCALE
PROPOSED OVERHEAD WIRE CROSSING OVER OHIO RIVER IN N W COR. OF SEC. 32, T2N, R10E.
CONDUCTORS:
12·354 MCM ACSR 30/19
STATIC WIRES:
2·7NO.8 ALUMOWELD STRAND
SAGS TAKEN @ 60°F NO WIND OR ICE. OPERATING VOLTAGE: 345 KV.
(OHIO RIVER DATUM)
EL 993
EL 765
228' (TYP)
T/FDN EL 765
SPAN = 3200'
2-STATIC WIRES · 7NO.8 ALUMOWELD STRAND
354 MCM ACSR 30/19 CONDUCTOR
do
do
EL 520
49.7'
EL 676
63' (TYP)
165' (TYP)
EL 612
HIGH WATER EL. 470.3
T/FDN EL 447
NORMAL POOL EL 420
LOW WATER EL 405.3
PROFILE
LOOKING UPSTREAM
VICINITY MAP
FROM OHIO RIVER MAP MC ALPINE POOL REACH, KENTUCKY & INDIANA
(N T S)
JEFFERSON CO. SALUDA TWP
CLARK CO. BETHLEHEM TWP
SQUAW CR
SEC 29
SEC 32
KENTUCKY
INDIANA
OHIO RIVER
FLOW
N
SEC 29
SEC 32

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

PROPOSED RIVER CROSSING

FIGURE 4.2.8-2

The existing right-of-way in Indiana now supports a 138-kV line; this will be replaced, along 17 miles of its length, with a 345-kV line. This new line will connect the Trimble County Switching Station with the Applicant's Northside Switching Station. The construction of this line will complete the Applicant's 345-kV system loop except for adding circuits as needed on existing transmission towers.

Another circuit would be added to the existing structures on the Trimble County-Middletown Line and the Trimble County-Northside Line when Trimble County Units 3 and 4 become operational.

The onsite switching station will have a "breaker-and-a-half" design consisting of galvanized steel structures with an intricate system of buses interwoven among them. All structures will be designed to have a low profile. Two auxiliary start-up transformers will be energized from the 345-kV switching station. These systems will provide offsite start-up, emergency power to the powerhouse auxiliary electrical system, and construction power.

Construction power will be obtained by extending an existing 138-kV line to the plant site. This line parallels the 345-kV line that will be the tie-in point for the plant. The 138-kV line will be strung on one side of the double circuit 345-kV towers constructed to provide the tie-in.

A typical steel lattice-type 345-kV transmission line tower is shown on Figure 4.2.8-3. A typical width for a 345-kV right-of-way is 120 to 150 feet, depending on terrain. The right-of-way for the Kentucky transmission line corridor will be 400 feet, because two circuits will be constructed in terrain requiring longer than average spans. The preliminary transmission line corridor chosen for Clark County, Indiana, will be from 120 to 150 feet wide, depending on the terrain.

The outdoor, liquid-filled power transformers located at the powerhouse will each be insulated and cooled with oil. Each transformer bay at the powerhouse will be equipped with fire detection and deluge-type fire protection systems. Each transformer will also be provided with an absorption or catch basin that will collect any spilled oil. If an oil leak occurs, the collected oil will be transferred from the catch basins to an interim storage basin, where it will be stored until it can be disposed of by acceptable means.

Design standards for the lines will meet or exceed applicable requirements of the National Electric Safety Code.

4.2.9 Atmospheric Emissions

The main boilers will emit SO_2, NO_x, and particulate matter to the atmosphere. The quantity of emissions will vary with the number of units in operation and with the load on each unit. The maximum emission rate will occur when all four units are operating at 100 percent load; this condition would exist, if ever, for only a few hours during the year. The average load over the first 20 years is expected to be 60 percent; therefore, the average rate of emissions will be 60 percent of the maximum described in this report.

Under full load conditions, the following maximum amounts of SO_2, NO_x, and particulates will be emitted to the atmosphere by the plant.

MAXIMUM CONCENTRATIONS (POUNDS PER HOUR)
OF SO_2, NO_x, AND PARTICULATES EMITTED
BY PLANT UNDER FULL LOAD CONDITIONS

Pollutants	Number of Units	Concentrations (lb/hr)
SO_2	Units 1 or 2	3,780
	Units 3 or 4	5,160
	Total all 4 units	17,880
NO_x	Units 1 or 2	3,400[a]
	Units 3 or 4	4,640[a]
	Total all 4 units	16,080[a]
Particulates	Units 1 or 2	250
	Units 3 or 4	340
	Total all 4 units	1,180

---

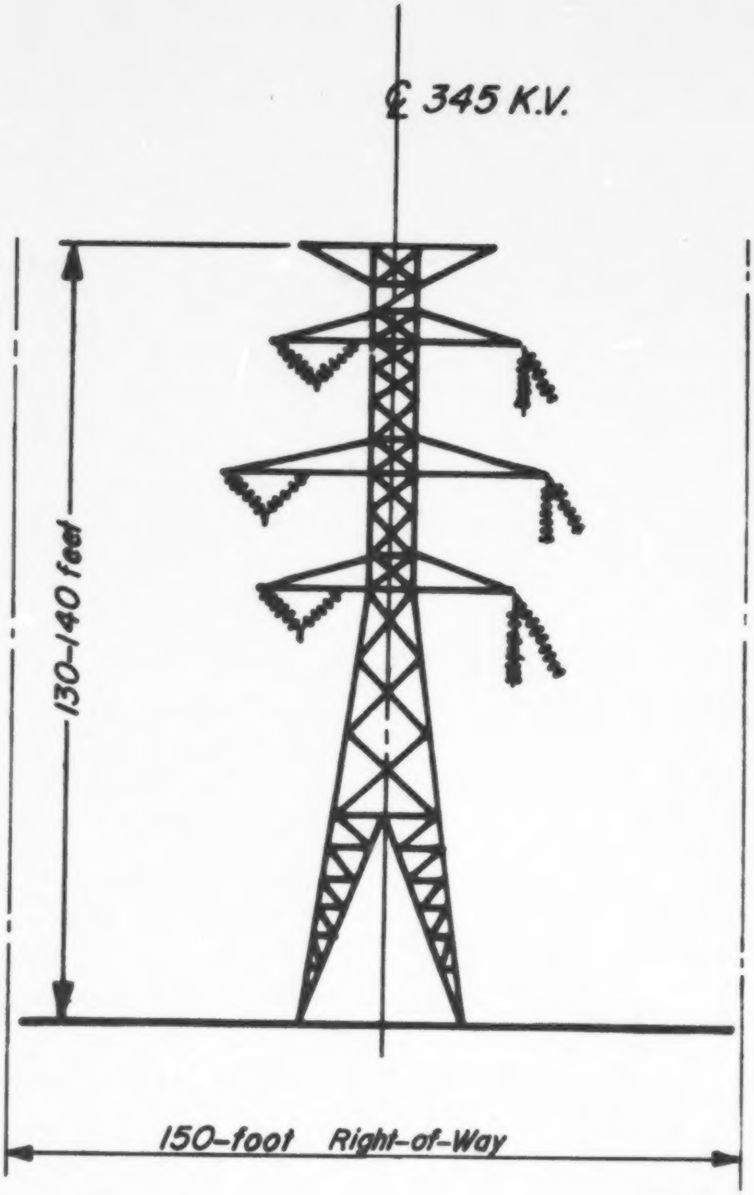
[a] Equivalent to 0.7 lb per million Btu heat input.

Sulfur dioxide emissions will be controlled with scrubbers. Kentucky Air Pollution Regulation 401 KAR 3:050, Section 3, sets the limits on SO_2 emissions at 1.2 lb per million Btu heat input per generating unit. The maximum SO_2 emission design limit for one unit of the Trimble County Generating Plant will be 5,160 lb/hr, which is equivalent to 0.78 lb of SO_2 per million Btu heat input.

Nitrogen oxide emissions from the plant will be controlled by the design of the boiler. Kentucky Air Pollution Regulation 401 also limits NO_x emissions to 0.7 lb per million Btu heat input. The boiler manufacturer will be required to guarantee that his product will comply with this emission rate.

Particulate emissions will be controlled by electrostatic precipitators operating at 99.6 percent efficiency. Kentucky Air Pollution Regulation 401 limits particulate emissions to 0.1 lb per million Btu heat input (485 lb/hr of particulates). The maximum particulate emission concentration from one unit of the Trimble County Generating Plant will be 340 lb/hr, which is equivalent to 0.051 lb of particulates per million Btu heat input.

Monitoring will be in accordance with Kentucky Air Pollution Control Regulation 401 KAR 3:050, Section 3. Levels of SO_2 emissions will be continuously monitored and recorded. There will also be a smoke detector and recorder.


℄ 345 K.V.
130-140 feet
150-foot Right-of-Way

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

TYPICAL TRANSMISSION TOWER

FIGURE 4.2.8-3

Source: Fluor Pioneer Inc., 1975

If it becomes apparent that an auxiliary boiler is required, an electric one probably will be chosen. Oil will be used for coal ignition, warm-up, and stabilization.

Fuel oil storage tanks will be of the floating roof type. Tank construction will comply with Kentucky Air Pollution Regulation 401 KAR 3:050, Section 10.

It is anticipated that fugitive dusting from the coal handling and storage facilities will be controlled by wet-type dust-suppression systems and by dust collectors. The fly ash storage silo will be equipped with a bag filter system for dust control. The fly ash handling system will comply with Kentucky Air Pollution Regulation 401 KAR 30:050, Section 14.

Large amounts of heat and water vapor will be discharged from the cooling towers. In addition, water droplets containing dissolved chemical salts will be released. Drift eliminators on the cooling towers will limit the distance traveled by the water droplets.

Impacts of the various atmospheric emissions from the plant are discussed in Section 6.0.

4.2.10 Noise Emissions

Ambient noise levels at the proposed Trimble County Generating Plant site are expected to increase during construction and operation of the plant. Construction sounds will be the initial source of noise and will continue through the completion (in 1989) of the last unit. Plant operational noises will begin after the start-up (in 1983) of Unit 1.

Construction noises will be produced by earth-moving equipment, piledrivers, crane and derrick engines, and trucks. The principal type of noise will be that produced by large horsepower diesel engines.

Principal potential operational noise sources are listed below:

Air compressors
High pressure relief valves
Atmospheric vents--air and steam
Barge unloading facilities--
  fuel and equipment
Coal handling equipment
Fans--induced and forced draft
Motors
Natural draft cooling towers
Precipitator rappers
Pumps
SO_2 removal equipment
Switchyard

During the construction of Units 2, 3, and 4, construction and operational noises will be mixed.

Operational sounds will be a combination of continuous and variable multilevel noises.

Impacts of construction and operation noise are discussed in Section 6.0; measures proposed to mitigate these impacts are discussed in Section 7.0.

4.3 CONSTRUCTION SCHEDULE, MANPOWER REQUIREMENTS, AND CONSTRUCTION FACILITIES

Construction of the proposed plant will take place over 14 years (see Table 4.3.1-1). The construction schedule is based on an 8-hour per day, 5-day per week work week. During these 14 years, the numbers of construction workers at the site will vary from a low of 20 to a high of 695 (see Table 4.3.1-2). Temporary construction facilities will be set up on the site and will include construction buildings, a parking lot, concrete batching plant, equipment unloading dock, and sanitary facilities. A system of collecting, storing, and treating stormwater runoff will be employed.

The following is a list of the major construction items.

Major Construction Items and Approximate Acreages[a]

Areas	Acreage
Onsite disposal pond	180
Screening berm	9
Rerouting of C.R. 1488	16
Borrow pit	40
Parking lot	4
Switchyard	7
Construction facilities (including laydown areas)	28
Power plant excavation	38
Access road to power plant excavation	4
Coal storage pile	45
Limestone storage pile	11
Cooling towers	4
Unloading area service roads	9
Sediment retention basin	9
Concrete batching plant	3
Solid waste treatment area	13
Water treatment area	1
Sewage treatment plants	less than .5 acre
TOTAL	421

---

[a] Indicates approximate acreage to be occupied by finished structure or component.

4.3.1 Construction Sequence

In order to minimize exposure of large areas of soil to erosion, and at the same time to preserve an orderly progress of power plant construction, the following construction work sequence will be followed:

TABLE 4.3.1-1

CONSTRUCTION SCHEDULE
TRIMBLE COUNTY GENERATING PLANT

Description of Activity	Start of Construction	Completion Date
Start of construction	7-1-78	-
Screening berm	7-1-78	9-1-78
Earthwork	7-1-78	6-1-85
Riverfront facilities	9-1-79	10-1-81
Coal handling facilities	1-4-80	1-1-83
Unit 1		
Concrete foundations	3-1-79	12-1-82
Structural steel	11-1-79	10-1-82
Chimney	3-1-80	1-1-82
Cooling tower	2-1-81	2-1-83
Boiler	1-1-81	3-1-83
Turbine Generator	12-1-81	5-1-83
Condenser	6-1-81	11-1-81
Start of commercial operation	-	6-1-83
Unit 2		
Concrete foundations	10-1-81	11-1-84
Structural steel	4-1-82	11-1-84
Boiler	12-1-82	3-1-85
Turbine generator	8-1-83	5-1-85
Condenser	3-1-83	11-1-83
Start of commercial operation	-	6-1-85
Unit 3		
Concrete foundations	10-1-83	11-1-86
Structural steel	4-1-84	11-1-86
Chimney	3-1-84	1-1-86
Cooling tower	10-1-84	2-1-87
Boiler	12-1-84	3-1-87
Turbine generator	8-1-85	5-1-87
Condenser	3-1-85	11-1-85
Start of commercial operation	-	6-1-87
Unit 4		
Concrete foundations	10-1-85	11-1-88
Structural steel	4-1-86	11-1-88
Boiler	12-1-86	3-1-89
Turbine generator	8-1-87	5-1-89
Condenser	3-1-87	11-1-87
Start of commercial operation	-	6-1-89

TABLE 4.3.1-2

ESTIMATED NUMBER OF CONSTRUCTION WORKERS AT THE PROPOSED TRIMBLE COUNTY GENERATING PLANT SITE, 1977 THROUGH 1991

Year	1978				1979				1980				1981				1982				1983				1984			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Workers	0	40	40	40	90	120	150	180	210	240	270	300	330	375	415	440	450	530	630	630	695	545	550	520	520	558	589	592
Average Number of Workers-Yearly Basis-Per Day	30				135				255				390				560				578				565			

Year	1985				1986				1987				1988				1989				1990				1991			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Workers	632	581	420	452	520	558	589	592	632	581	420	452	520	558	589	592	632	581	420	300	173	108	68	61	60	40	40	20
Average Number of Workers-Yearly Basis-Per Day	521				565				521				565				483				103				40			

1. Equipment Barge Unloading Facility and Access Road from Barge Unloading Area to Existing Road 1488 - This facility is needed early to transport large earthmoving equipment to the site. Installation of the cells will use a barge-mounted pile driver. Upon installation of cells, fill material for the shore side of the cellular structure will be transported from the site of the future onsite disposal pond

2. Sediment Retention Basin Dam - Construction of this dam, together with the control facilities, will make the runoff control system operational for the next construction phase. Earth for the dam will also be taken from the future onsite disposal pond area

3. Relocation of State Road 1488 - Existing State Road 1488 is to be relocated to the east, parallel to the toe of the high bluffs. This will be accomplished during the early construction phase to improve the security of the construction area and permit work to commence in the area occupied by the existing road

   Deposits of good impervious clay have been found in the area parallel to the new road. This clay is to be moved and stored temporarily in the area designated for the future coal pile and may possibly be used later as an impervious liner in the coal pile and disposal pond areas. The clay removed from the borrow pit is to be replaced with granular soils from the future onsite disposal pond area. Construction of the new road can then proceed

   Construction runoff from the borrow pit will be drained to the sediment retention basin. Runoff from the road will be diverted to Corn Creek and Barebone Creek without treatment. Unpaved areas will be immediately seeded or otherwise protected

4. Temporary Construction Facilities - Temporary construction facilities will be constructed in several phases. Earthwork, construction roads, and foundations will be put in place and the disturbed areas paved, surfaced with crushed stone, or seeded or mulched. Interception of runoff from this area is not required

5. Power Plant and Equipment Laydown Area -- The area designated for the power plant has approximately 15 feet of granular soil not capable of supporting the power plant structures. This stratum will be removed, replaced in part with suitable soils coming from the onsite disposal pond area, and recompacted in place. The entire excavation and recompaction operation will be performed within the power plant area. The operation will encompass the four-unit area. Runoff during construction from this area will be intercepted and diverted into the runoff retention basin

6. Cooling Towers - Runoff from these two areas during the construction phase will be intercepted and will flow by gravity into the runoff retention basin

7. Coal and Limestone Storage Piles - These areas will require permanent dikes designed to intercept runoff from coal and limestone piles. The storage areas will be constructed early for possible use for stockpiling of select soils to be used in the construction of the onsite disposal pond. Sheet runoff from the storage areas will not be treated

   Dikes constructed later will be lined with impervious clay and surfaced with crushed stone or seeded with crown vetch. Runoff will be taken to the sediment retention pond

8. Onsite Disposal Pond - Construction of the onsite disposal pond will constitute the largest earthwork operation during the construction of the power plant

   The interior of the pond area will be excavated to an approximate elevation of 430 feet. As excavation proceeds, exterior dikes will use the excavated soils. As work proceeds, exterior slopes of the dikes will be protected from runoff erosion by seeding. The riverside exterior dike will require heavy riprap lining or crown vetch to prevent erosion due to river flow

   A sump is to be constructed in the southeast corner of the pond interior. As excavation proceeds, the bottom of the pond will be sloped toward the sump. The collected runoff during the construction period will be pumped to a ditch leading to the runoff retention basin

4.3.2 Construction Facilities

Temporary construction facilities for the proposed power plant will consist of the following:

1. Security fencing
2. Parking lot
3. Construction buildings (two warehouses, paint shop, two electrical shops, pipe fabrication shop, riggers' shop, garage, carpenters' shop, tool storage building, office building, air compressor building, and washroom building)
4. Laydown areas
5. Concrete batching plant
6. Equipment unloading facility
7. Water and power facilities

The area involved for temporary construction activities is as follows

Parking area	4 acres
Roads	5 acres
Buildings	7 acres
Concrete batching plant	3 acres
Laydown areas	21 acres
	40 acres

Security Fencing and Parking Lot

During the initial construction phases, a permanent security fence will be built around the plant site. The fence will run along the southern boundary of the site east to the relocated road. It will then run north, parallel to the relocated road and the dike of the onsite disposal pond. On reaching the end of the dike, the fence will proceed west toward the river.

Additional temporary fencing will be placed around the parking lot. Private vehicles driven to the plant site will proceed into the parking lot without passing through any gate house or guardhouse. From the parking lot, construction workers will proceed to a man-gate west of a temporary gate house.

A road for construction deliveries will pass east of the temporary gate house. Vehicles entering the construction area will be checked and inspected at this point.

The proposed parking lot will occupy 4 acres and provide parking for a maximum of 695 construction workers.

Table 4.3.2-1 presents an estimate of total daily construction traffic. Table 4.3.2-2 presents an estimate of daily truck traffic.

Construction Buildings

Some or all of the temporary construction buildings will be taken from the Applicant's Mill Creek Generating Station site. These buildings will be located in the area south of proposed Unit 4 and immediately adjacent to the major laydown areas.

Laydown Areas

The major laydown area will be located south of proposed Unit 4. The two major laydown areas will contain approximately 15 acres.

A future laydown area is indicated for the construction of Units 3 and 4. This area is located directly north of the proposed cooling tower for Units 3 and 4, and it totals approximately 6 acres.

All laydown areas will be at a nominal elevation of 470 feet, which will preclude any serious flooding problems.

A grid system of graveled roads will be provided within the laydown areas.

TABLE 4.3.2-1

TRIMBLE COUNTY GENERATING PLANT SITE - ESTIMATED CONSTRUCTION TRAFFIC (PER DAY) - 1978 THROUGH 1991

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Average Number of Workers-Yearly Basis[a]	30	135	255	390	560	578	565	521	565	521	565	483	103	40
Average Number of Passenger Vehicles[b]	20	90	170	260	373	385	377	347	377	347	377	322	69	27
Average Number of Trucks[c]	23	23	23	23	23	23	23	23	23	23	23	23	10	3
Total Vehicles[d]	43	113	193	283	396	408	400	370	400	370	400	345	79	30

---

[a] Based on Table 4.3.1-2.

[b] Based on an estimate of 1.5 passengers per vehicle. This factor was also used for the sizing of the parking lot.

[c] See Table 4.3.2-2.

[d] Total vehicles contributing to the daily traffic.

TABLE 4.3.2-2

ESTIMATE OF DAILY TRUCK TRAFFIC DURING CONSTRUCTION OF TRIMBLE COUNTY GENERATING PLANT[a]

Type of Service	Number of Trucks	Number of Round Trips/ Day/Truck	Total Round Trips
Aggregate and Sand[a]	-	Assume barge delivery	-
Cement[a]	-	Assume barge delivery	-
Lumber	1	1	1
Fuel	1	1	1
Waste Disposal	1	1	1
Other Deliveries	20	1	20
Major Equipment & Materials	-	Assume barge delivery	-

---

[a] Concrete batching plant will be built onsite.

Concrete Batching Plant

It is estimated that the largest pour of concrete required for this project will be 1,600 cubic yards in one 12-hour day; therefore, the plant will be sized for a capacity of 150 cubic yards per hour. The major portion of the concrete pouring (approximately 55,000 cubic yards) for Unit 1 will be accomplished in 17 months. Figured on an average of 20 work days per month, the average daily output for this period will be 160 cubic yards per day.

It is possible that unforeseen difficulties might interrupt the supply of materials for the concrete batching plant. Therefore, the batching plant is sized to allow storage for a 3-month supply of basic materials.

A minimum of 57,600 cubic feet of volume will be required for storing the 3-month supply of materials. Cement will be stored in five bins approximately 20 feet in diameter by 40 feet high. Aggregate to be stored onsite will amount to 179,000 cubic feet. This will require a storage pile approximately 450 feet long by 20 feet high. Storage for sand will require 118,000 cubic feet, which will require a pile 300 feet long by 20 feet high.

The total batching facilities will occupy an area 280 feet by 380 feet, allowing for 40-foot roadways between piles of material and around all sides. The total area required is about 3 acres.

Equipment Unloading Facility

Major plant equipment and materials will be delivered by barge and unloaded at the equipment unloading dock (see Section 4.2.6).

Water and Power Facilities

Water Supply

During construction, water will be required for the concrete batching plant, drinking purposes, sanitary facilities, fire protection, hydrotesting, soil compaction, and dust suppression. Water for the concrete batching plant, drinking purposes, dust suppression, and sanitary facilities will be provided by deep wells. All other water requirements will be supplied by the Ohio River.

The maximum water requirements for the concrete batching plant, drinking purposes, dust suppression, and sanitary facilities will be approximately 100,000 gallons per day. This requirement is based on a maximum concrete pour of 1,600 cubic yards per day, sanitary facilities and drinking water for 400 construction personnel, and drinking water only for an additional 295 construction personnel. The average daily use during construction for the above items will be approximately 44,000 gallons per day.

In order to fulfill these requirements, two 60-gpm wells will be required, plus a 20,000-gallon storage tank. The water used for drinking will require settling and chlorination. In order to provide a redundant water source, two wells will be installed. (After construction, these wells will provide potable water for the approximately 350 operating personnel required for plant operation.)

Sanitary Facilities and Waste Treatment

Sanitary facilities for the project are discussed in Section 4.2.3 under "Plant Wastewater Discharges."

Rubbish and rubble will be collected and hauled away constantly to remove unpleasant sights and offensive odors.

Construction Power

Initial construction power will be supplied from the local utility's distribution line, which is in the vicinity of the south border of the construction site. A stepdown transformer rated at approximately 2,000-kVA will be furnished, along with a distribution system to serve the site construction facilities.

4.3.3 Sediment Retention Basin

The stormwater runoff system will consist of a sediment retention basin and several corollary structures designed to direct runoff into it or away from construction excavations. Located on the western edge of the site at the Ohio River, the basin will be formed by an existing natural drainageway and an earth dam. It will hold 113 acre-feet of runoff, more than twice the amount (approximately 40 acre-feet) from a 10-year, 24-hour rainfall in the area tributary to it. (Basin capacities for various other runoff inflows are listed in Table 4.3.3-1). Ditches and culverts will direct runoff from distant construction areas into the basin. Diversion dikes and filter berms will intercept runoff. The dikes, which will be low-profile earth structures, will direct the runoff away from excavations or toward the basin; berms, composed of granular material, will intercept and filter runoff from construction areas.

The sediment retention basin will be divided into two compartments. One compartment will contain the runoff from the coal and limestone storage piles. The runoff in this compartment will be monitored before being released to the second compartment and then to the Ohio River. Except for the runoff from the coal and limestone storage areas, all other runoff requiring retention will be diverted directly to the second compartment, which will discharge to the Ohio River.

TABLE 4.3.3-1

SEDIMENT RETENTION BASIN CAPACITIES FOR VARIOUS INFLOWS
TRIMBLE COUNTY GENERATING PLANT

Contour Elevations @ 2-Ft Intervals	Area	Basin Capacities		
			Cumulative	
	(thousand sq ft)	(thousand cu ft)	(thousand cu ft)	(acre feet)
438	6.96	3.48	3.48	0.08
440	21.79	28.75	32.23	0.74
442	43.55	65.34	97.57	2.24
444	95.78	139.39	236.96	5.44
446	173.42	269.20	506.16	11.62
448	224.29	397.71	903.87	20.75
450	278.82	503.11	1406.98	32.30
452	300.97	579.79	1986.77	45.61
454	349.38	650.35	2637.12	60.54
456	356.73	706.11	3343.23	76.75
458	406.44	763.17	4106.40	94.27
460	425.12	831.56	4937.96	113.36

Adjustment of pH value, monitoring of the quantity of suspended solids, removal of oil and grease, and release of the retained runoff into the Ohio River will be controlled in the area of the dam.

The site may be divided into three separate areas: (1) areas subject to runoff control based on 40 CFR Part 423 (see Section 4.2.3); (2) areas disturbed by construction but not subject to control; and (3) areas tributary to and within the site not disturbed and not subject to control.

1. Areas requiring runoff interception:
    a. Power plant
    b. Cooling towers
    c. Equipment and material laydown areas
    d. Any other area with "sheet type" runoff collected in ditches and resulting in a point discharge
2. Areas and activities not requiring runoff interception:
    a. General site grading
    b. Roads and parking areas
    c. Switchyard
    d. Coal storage area
    e. Limestone storage area
    f. Temporary construction facilities
    g. Onsite disposal pond
    h. Small miscellaneous structures

Runoff from the stable, non-leachable processed flyash/scrubber sludge landfill (Section 4.2.5) in Ravines RA and RB will be impounded, sampled, and treated as required before being discharged to the natural, undeveloped area of the ravines. The runoff will flow from the ravines to Corn Creek to the Ohio River. Runoff from the undeveloped areas of the ravines will not require runoff interception. If, after a period of time, the runoff from the processed landfill consistently indicates that settling and treatment is not required, the runoff will be discharged directly without impoundment.

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5.0 ENVIRONMENTAL SETTING OF PROPOSED PROJECT

5.1 ATMOSPHERE

5.1.1 Climatology and Meteorology

Data Sources

The climate of the Trimble County site area has been established from National Weather Service data from Louisville, Kentucky (30 miles to the southwest) and Cincinnati, Ohio (50 miles to the northeast). Additional material has been used as indicated in the list of references.

General Climate

Located well inland, the Trimble County Plant site has a typically moderate continental climate, with warm humid summers and cold winters. Summer weather is dominated by the southerly flow of unstable air originating over the Gulf of Mexico, resulting in frequent thundershower activity. In winter, a polar front is often situated near the Ohio River valley resulting in occasional cloud cover, rain, and sometimes snow. Storminess in late spring and in autumn is considerably less frequent.

Extreme temperatures in the Trimble County area have ranged from a maximum of 109°F to a minimum of -19°F. Average daily temperatures range from the mid 30's in January to the upper 70's in July. Annually, there is an average of approximately 30 days with a temperature of 90°F or above and approximately 85 days with a temperature of 32°F or below. Only on an average of once per year does the minimum temperature drop below 0°F.

The relative humidity for a given atmospheric moisture content is inversely proportional to temperature, so that highest relative humidities can be expected in the early morning hours and lowest relative humidity in mid-afternoon. Average diurnal variations of relative humidity for Louisville and Cincinnati are presented in Tables 1 and 2, Appendix H. Normally, relative humidity is highest at 0600 or 0700, as indicated in Table 2 for Cincinnati. However, an anomaly exists at Louisville, where relative humidity is highest at midnight. No explanation can be given for this phenomenon. Relative humidity at or near saturation (relative humidity = 100 percent) is occasionally accompanied by dense fog in which visibility is restricted to less than 0.25 mile.

The average number of days per month on which dense fog is observed at Louisville and Cincinnati is noted below:

Month	Louisville	Cincinnati
January	2	2
February	1	2
March	1	1
April	*	1
May	*	*
June	*	*
July	*	1
August	*	1
September	1	2
October	1	3
November	1	2
December	2	3
Annual	9	18

*Less than 0.5 day

Since fog is a local phenomenon, there is a considerable difference between Louisville and Cincinnati[1] due principally to the topography and distance from the Ohio River. Dense fog is likely to be more frequent over and adjacent to the Ohio River; consequently, it occurs more frequently at Cincinnati.

Average annual rainfall ranges from 41.47 inches at Louisville to 39.34 inches at Cincinnati. The monthly distribution of rainfall at these two cities is shown in Table 3, Appendix H. The greatest rainfall observed in any 24-hour period was 5.80 inches. Annual snowfall generally increases from Louisville to Cincinnati with 13.4 inches and 17.3 inches observed at each station respectively. The heaviest 24-hour snowfall was 15.0 inches (Water Information Center, Inc., 1974).

Severe Weather

Annually, there are approximately 49 days on which thunderstorms are observed in the site area, particularly between June and August. In spring, however, conditions are sometimes favorable for the formation of severe thunderstorms capable of producing tornadoes.

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[1] I.e., Louisville and Cincinnati airports.

The last major tornado outbreak in the area occurred on April 3-4, 1974, when a funnel "touched down" in extreme southern Indiana causing extensive damage in Madison (Public Service Indiana, 1975, page 2.6-11). During this episode, other tornadoes damaged sections of Louisville and Cincinnati. Annually, an average of one tornado per year can be expected in an approximately 4,100-square-mile area which includes Trimble County and parts of northern Kentucky and southeastern Indiana (Thom, 1959).

Destructive winds of greater than 40 mph are usually associated with thunderstorms or intense low pressure areas. At a height of 30 feet, extreme mile wind speeds (the passage of 1 mile of wind with the greatest speed) of approximately 49 mph, 80 mph, and 85 mph are likely to be equalled or exceeded once every 2, 50, and 100 years respectively (Thom, 1963). At Louisville, the fastest mile wind on record was 68 mph from the northwest.

Because Trimble County is located well inland from the ocean, it is very unlikely that the site will ever experience the full force of a hurricane; however, the "remnants" of tropical cyclones sometimes pass through the area, bringing heavy rain.

Diffusion Climatology

The potential transport and diffusion of air pollutants can be evaluated both qualitatively and quantitatively on the basis of wind speed and direction, atmospheric stability, and mixing depth.

Wind Direction and Wind Speed Frequency Distribution at the Trimble County Site

Tables 4 and 5, Appendix H, present the annual average distribution of wind direction and wind speed at Louisville and Cincinnati respectively for the 10-year period 1951 through 1960. These data indicate that the annual prevailing wind is roughly from the south through south-southwest at an average speed of approximately 12 mph. Calm conditions are likely to be observed 4.5 percent of the time annually.

Summaries of monthly variations of wind direction frequencies for Louisville and Cincinnati are presented in Tables 6 and 7, Appendix H. Note that the only months during which winds with a strong southerly component are not dominant are February and March at Louisville and only March at Cincinnati. Average wind speed is lowest during the summer months when northern hemispheric circulation is weakest.

Pasquill Stability Classes

Generally, the horizontal and vertical dispersion of an effluent is greatest during unstable conditions and minimal during stable conditions (most often associated with nocturnal radiation inversions). The characteristics of atmospheric stability for any particular location may be conveniently summarized through the use of Pasquill Stability classifications, in which classes A through C represent the unstable situations, E represents the stable situation, and D the neutral situation.

An annual joint wind direction and stability class frequency distribution generated from 1964 data collected at Standiford Airport in Louisville is presented in Table 8, Appendix H. These data were used to evaluate the dispersion of airborne effluents in relation to air quality regulations, as discussed in Section 6.1. While the total frequencies for each wind direction do not precisely reflect those for Cincinnati and Louisville (Tables 4 and 5, Appendix H), the relative distribution is quite similar. Although the distribution for stable and neutral classes resembles the distribution for all classes combined, there is a disproportionately higher frequency of southeast winds associated with stability class E. This is probably a function of topography in the vicinity of the airport as it affects cold air drainage flow patterns during stable conditions.

Overall, unstable, neutral, and stable conditions can be expected to occur 20.8 percent, 42.1 percent, and 37.1 percent of the time respectively.

Mixing Layer Heights and Wind Speeds

Seasonal and annual mixing layer heights and wind speeds for the morning and afternoon hours at Huntington, West Virginia (the nearest radiosonde station considered to be representative of local conditions and with an adequate period of record for the diffusion studies) are presented in Table 9, Appendix H. Mixing height is that level to which pollutants may be dispersed by turbulent and convective atmospheric mixing processes. The mixing layer wind speed is the average speed through this layer. In general, afternoon mixing depths are greatest in summer due to intense surface heating. Conditions are usually poorest in the autumn season when mixing heights are low and wind speeds light.

Stagnating Anticyclones and Air Pollution Potential

A high air pollution potential is a state of the atmosphere conducive to the accumulation of gaseous and/or particulate pollutants.

This condition is generally associated with a low mixing height and a low wind speed within the mixing layer. Both of these are often associated with a stagnating anticyclone (stationary high pressure area). According to Holzworth (1972), approximately 4 to 5 such days can be anticipated per year based on forecasts issued between 1960 and 1963. An analysis by Korshover (1967) of stagnating anticyclones occurring over a 30-year period produced almost identical results. It should be noted that the above frequency was obtained by interpolating data from charts depicting national distributions.

5.1.2 Ambient Air Quality

Air Quality Regulations and Standards

Commonwealth of Kentucky and federal ambient air quality standards are presented in Table 5.1.2-1. In general, Kentucky standards are identical to federal standards, with the exception of hydrogen sulfide and settleable particulate standards, which are state standards only. In Table 5.1.2-1, primary standards define those pollutant level limitations judged necessary to protect public health with an adequate margin of safety; secondary standards define pollutant level limitations judged necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

The Trimble County site lies in the extreme northeast portion of the North Central Kentucky Air Quality Control Region (AQCR). In each AQCR, pollutants have been given a priority classification from I to III, based on existing pollution levels. These classifications provide an indication of the degree to which air quality could be improved by control programs. These classifications are related to the previously described primary and secondary standards. A Priority I classification is indicative of high pollution levels usually in excess of the primary standard, and, conversely, a Priority III is indicative of low pollution levels. Priority classifications of pollutants in any region as a function of pollutant concentrations are shown in Table 5.1.2-2. Note that priority classifications for pollutants in the North Central AQCR are listed on the left side of the table. Particulate matter (classified Priority II) is the only pollutant with concentrations in excess of the secondary standard according to priority classifications (Commonwealth of Kentucky, 1974c).

In order to prevent significant deterioration of ambient air quality, the Environmental Protection Agency (EPA) enacted regulations on 5 December 1974 (which were amended in August 1977) which limited the amount to which particulate and sulfur dioxide (SO_2) concentrations could be increased by new sources, depending on the priority classification of an area. The allowable increases are smallest in Class I or pristine areas and largest in Class II areas where well controlled emissions would not significantly degrade air quality in the area (Federal Register, 1974).

TABLE 5.1.2-1

KENTUCKY AND FEDERAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Interval	Primary Standard ($\mu g/m^3$)	Secondary Standard ($\mu g/m^3$)
Sulfur Dioxide	3-Hour	-	1,300
	24-Hour	365	-
	Annual Average	80	-
Total Suspended Particulates	Annual Geometric Mean	75	60
	24-Hour[a]	260	150
Settleable Particulates[b]	3-Month	-	15[c]
Carbon Monoxide	1-Hour	40,000	40,000
	8-Hour	10,000	10,000
Nitrogen Oxides	Annual Average	100	100
Hydrogen Sulfide[b]	1-Hour	-	14
Photochemical Oxidants	1-Hour	160	160
Nonmethane Hydrocarbons	3-Hour (6-9 a.m.)	160	160

---

[a] Not to be exceeded more than once per year.

[b] Kentucky standard only.

[c] Tons per square mile per month.

Source: Commonwealth of Kentucky, 1974c

TABLE 5.1.2-2

AIR QUALITY CONTROL REGION (AQCR) PRIORITY CLASSIFICATION AS A FUNCTION OF EXISTING POLLUTANT CONCENTRATIONS

		Priority as a Function of Pollutant Concentration			
Pollutant	Averaging Interval	I Greater Than ($\mu g/m^3$)	II From - To ($\mu g/m^3$)	III Less Than ($\mu g/m^3$)	Pollutant Classification in North Central Kentucky AQCR
Sulfur Dioxide	Annual	100	60-100	60	III
	24-Hour	455	260-455	260	
Particulates	Annual	95	60-95	60	II
	24-Hour	325	150-325	150	
Carbon Monoxide	8-Hour	14,000		14,000	III
	1-Hour	55,000		55,000	
Nitrogen Dioxide	Annual	110[a]		110	III
Photochemical Oxidants	1-Hour	195[a]		195	III

---

[a] Greater than or equal to.

Source: Commonwealth of Kentucky, 1974c

The proposed site falls within an area designated by the EPA as Class II in which the increase in sulfur dioxide and particulate concentrations contributed by a new source or sources may not exceed the following increments.

Significant Deterioration Increments

Emission	Concentrations ($\mu g/m^3$)
Particulate Matter	
Annual Geometric Mean	19
24-Hour Maximum	37
Sulfur Dioxide	
24-Hour Maximum	91
3-Hour Maximum	512
Annual Arithmetic Mean	20

Commonwealth of Kentucky (1974c) emission regulations applicable to the Trimble County site include:

1. New indirect heat exchangers limited to 0.10 pounds of particulate emissions per million Btu heat input per hour when in excess of 250 million Btu's per hour.

2. Smoke discharge shall not exceed Shade No. 1 on the Ringelmann Chart

3. New indirect heat exchangers limited to 1.2 pounds of sulfur dioxide (based on coal-fired units) for a 2-hour average per million Btu of heat input per hour when in excess of 250 million Btu's per hour

Regional Air Quality

Commonwealth of Kentucky (1974d) emissions data indicate that the largest single point source (emissions from a single stack or location) within 20 miles of the proposed plant site is the Clifty Creek Power Plant located near Madison, Indiana, approximately 10 miles to the north. The emission rate of sulfur dioxide from the Clifty Creek plant is 289,712 tons per year; the emission rate of particulates is 9,404 tons per year (EPA, 1977).

Existing ambient air quality has been evaluated in relation to the secondary standards (see Table 5.1.2-1). The available Kentucky and Indiana ambient air quality monitoring network data for locations within approximately 20 to 30 miles of the Trimble County site are presented in Table 5.1.2-3. Ambient concentrations of total suspended particulates, sulfur dioxide, and nitrogen dioxide have been generally well below the secondary standards and relatively consistent between 1972 and 1974. In the vicinity of the site, average particulate concentrations ranged from 45 to 55 $\mu g/m^3$, and both nitrogen dioxide and sulfur dioxide concentrations ranged from 15 to 25 $\mu g/m^3$.

To evaluate the influence of the Clifty Creek Power Plant on ambient air quality, American Electric Power conducted a monitoring program at six locations in the vicinity of the plant (see Figure 5.1.2-1) during the period February 1974 through January 1975. Observed concentrations of sulfur dioxide, particulates, and oxides of nitrogen are presented in Table 5.1.2-4. Note that, at several locations, the secondary and/or primary ambient air quality standards for sulfur dioxide and particulates were exceeded.

Onsite Air Quality

A monitoring program was conducted at the Trimble County site during 1975 for approximately one 30-day period in each of the spring, summer, autumn, and winter periods to measure pollutant levels and to document meteorological conditions during sampling. Measurements were made at a total of five locations (shown in Figure 5.1.2-1 and listed by name in Table 5.1.2-5) with two portable instrumented trailers which alternated between the locations according to the schedule in Table 5.1.2-6. The following parameters were monitored continuously:

TABLE 5.1.2-3

SUMMARY OF KENTUCKY AND INDIANA AMBIENT AIR QUALITY DATA FOR STATIONS IN THE VICINITY OF THE TRIMBLE COUNTY GENERATING PLANT SITE

		Total Suspended Particulates			Sulfur Dioxide[a]			Nitrogen Dioxide[a]		
Station[b]	Year	Number of Observations	Highest Value ($\mu g/m^3$)	Geometric Mean ($\mu g/m^3$)	Number of Observations	Highest Value ($\mu g/m^3$)	Arithmetic Mean ($\mu g/m^3$)	Number of Observations	Highest Value ($\mu g/m^3$)	Arithmetic Mean ($\mu g/m^3$)
La Grange, Ky.	1973	NA[c]	91	55	-	-	-	-	-	-
	1974	56	109	47	56	84	13.1	56	NA	15.3
Carrollton, Ky. (Middle School)	1972	NA	104	50	NA	81	20.2	NA	NA	16.6
	1973	NA	123	48	NA	68	13.7	NA	NA	15.5
	1974	60	120	50	60	139	16.4	60	NA	19.2
Carrollton, Ky. (Sid May Farm)	1974	17	112	45	-	-	-	-	-	-
Carrollton, Ky. (P. Carraro Farm)	1974	10	109	49	-	-	-	-	-	-
Carrollton, Ky. (Martin Nursery)	1974	15	149	62	-	-	-	-	-	-
Charlestown, Ind.	1972	9	106	63	-	-	-	-	-	-
	1973	10	174	119	12	34	15.7	12	58	16
	1974	57	119	58	40	118	25.7	50	77	28.6
	1975	28	99	50	24	97	21.4	22	66	21.4
Madison, Ind.	1973	29	68	36	20	126	23.6	25	60	12
	1974	52	107	41	50	94	17.8	50	47	12.4
	1975	27	87	32	28	29	14.5	27	220	29.0

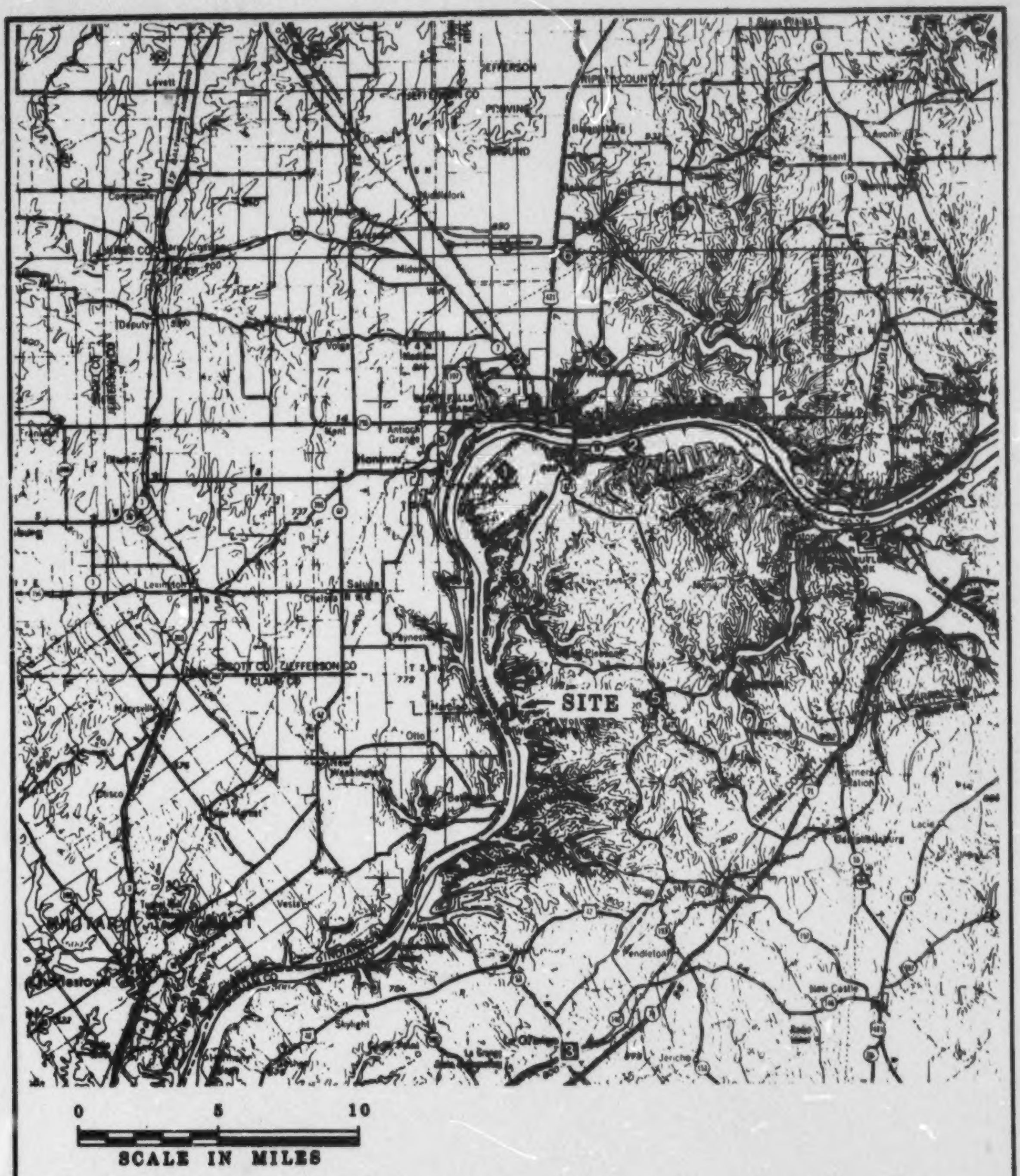
---

[a] Based on 24-hour bubblers.

[b] Locations with reference to site are shown on Figure 5.1.2-1.

[c] Not available.

Source: Commonwealth of Kentucky, 1975b
State of Indiana, 1975


JEFFERSON
RIPLEY COUNTY
Lovett
Deputy
Volga
Kent
Hanover
Lexington
Saluda
Chelsea
Paynesville
SITE
Otto
New Washington
Pendleton
New Castle
La Grange
Jericho
0
5
10
SCALE IN MILES

◆ IKEC-CLIFTY CREEK FIELD MONITORING NETWORK

① TRIMBLE COUNTY GENERATING PLANT BASELINE SAMPLING STATIONS

▣ KENTUCKY AND INDIANA AIR QUALITY MONITORING STATIONS

(SEE TABLE 5.1.2-5)

N

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

AIR QUALITY SAMPLING WITHIN VICINITY OF SITE

FIGURE 5.1.2-1

TABLE 5.1.2-4

SUMMARY OF AIR QUALITY DATA FROM THE IKEC-CLIFTY CREEK AIR MONITORING SYSTEM FOR THE PERIOD FEBRUARY 1974 THROUGH JANUARY 1975[a]

(Concentrations in μg/m^3)

Pollutant	Monitoring Location					
	Liberty Ridge (1)	Canip Creek (2)	North Madison (3)	Bacon Ridge (4)	Rykers Ridge (5)	Hebron Church (6)
Sulfur Dioxide						
Number of Hourly Observations	6,945	6,346	7,428	7,538	6,921	7,766
Annual Arithmetic Mean	44.5	28.8	47.2	31.4	39.3	28.8
24-Hour Maximum	278	191	459	267	212	267
3-Hour Maximum	692	1,079	1,289	519	880	582
1-Hour Maximum[b]	828	1,365	1,955	686	1,166	762
Times > 365 (primary standard)[c]	0	0	2	0	0	0
Times > 260 (secondary standard)[d]	2	0	6	0	0	1
Times > 1,300 (secondary standard)	0	0	0	0	0	0
Total Suspended Particulates						
Number of 24-Hour Observations	343	325	335	303	331	327
Annual Geometric Mean	48.8	51.5	57.8	43.9	49.9	47.5
24-Hour Maximum	285	152	250	163	216	137
Times > 260 (primary standard)	1	0	0	0	0	0
Times > 150 (secondary standard)	1	1	8	2	2	0
Oxides of Nitrogen						
Number of Hourly Observations	6,285	-	-	5,529	1,069	-
Annual Arithmetic Mean	46.0	-	-	50.0	52.0	-

---

[a] Indiana-Kentucky Electric Corporation operates 7 monitoring stations in the Madison area, but data are available for only 6.

TABLE 5.1.2-4 (Continued)

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[b] At the time monitoring was conducted, Indiana had a 1-hour SO_2 secondary standard of 1,100 μg/m^3. This has since been removed from the Indiana ambient air quality rules and regulations and a 3-hour secondary standard of 1,300 μg/m^3 imposed.

[c] The federal and Indiana 24-Hour Primary Standard is 365 μg/m^3. The number of times > 365 represents the number of days on which a 24-hour running mean exceeded 365 μg/m^3.

[d] The Indiana 24-Hour Secondary Standard is 260 μg/m^3. The number of times > 260 represents the number of days on which a 24-hour running mean exceeded 260 μg/m^3.

Source: Indiana-Kentucky Electric Corporation, 1975.

TABLE 5.1.2-5

AIR QUALITY MONITORING STATION NAMES[a]

IKEC-Clifty Creek Field Monitoring Network

Number	Station Name
1	Liberty Ridge, Indiana
2	Canip Creek, Indiana
3	North Madison, Indiana
4	Bacon Ridge, Indiana
5	Rykers Ridge, Indiana
6	Hebron Church, Indiana

Trimble County Generating Plant Baseline Air Quality Sampling Stations

Number	Station Name
1	Wises Landing, Kentucky
2	Jones, Kentucky
3	Wentworth, Kentucky
4	Willis, Kentucky
5	Bedford, Kentucky

Kentucky and Indiana Air Quality Monitoring Stations

Number	Station Name
1	Madison, Indiana
2	Carrollton, Kentucky
3	La Grange, Kentucky
4	Charlestown, Indiana

---

[a] Refer to Figure 5.1.2-1 for locations of stations.

TABLE 5.1.2-6

ONSITE AMBIENT AIR QUALITY MONITORING SCHEDULE 1975
TRIMBLE COUNTY GENERATING PLANT

Sampling Period	Monitoring Location[a]				
	Wises Landing	Willis	Jones	Wentworth	Bedford
Spring					
Start	4/26	4/30	5/19	-	-
Stop	5/26	5/18	5/26	-	-
Total Days	31	19	8	-	-
Summer					
Start	7/25	7/5	7/5	7/30	-
Stop	8/11	7/29	7/25	8/11	-
Total Days	18	25	21	13	-
Autumn					
Start	9/15	-	-	9/15	9/30
Stop	10/16	-	-	9/30	10/16
Total Days	32	-	-	16	16
Winter					
Start	11/14	-	-	11/14	12/2
Stop	12/29	-	-	12/2	12/30
Total Days	45			18	28
Total Days of Sampling for the Entire Period	126	44	29	47	44

---

[a] Refer to Figure 5.1.2-1 for locations of monitoring stations.

Wind direction (tens of meters)

Wind speed (tens of meters)

Wind direction--standard deviation

Temperature

Sulfur dioxide

Nitrogen dioxide

Nitric oxide

Total oxidants (as ozone)

Carbon monoxide

Hydrocarbons

Data were recorded as 15-minute averages on a digital paper-punch system and were later reduced to 1-hour averages.

Total suspended particulates were measured at both trailers on alternate days for a 24-hour period. Hydrogen sulfide was measured periodically by means of a tape sampler in the spring; however, this was discontinued in subsequent sampling periods because concentrations were below the detectable limit of 0.001 ppm. Results of the spring, summer, autumn, and winter sampling and a summation of all the periods are presented in Tables 5.1.2-7 through 5.1.2-11. While the sampling periods were much too short to establish meaningful comparisons with annual average standards, they are sufficient to provide an indication of local tendencies. The following comments refer to the summary values presented in Table 5.1.2-12.

Sulfur Dioxide

Concentrations of sulfur dioxide at all of the monitoring sites were slightly higher than those observed at Kentucky and Indiana monitoring locations but were still well within the secondary standards. Generally, atmospheric conditions in summer and autumn are most conducive to high pollutant concentration; however, the onsite data indicate that concentrations were highest in the spring and winter. This is possibly a function of residential and commercial space heating emissions.

To evaluate the influence of the Clifty Creek Power Plant on sulfur dioxide levels, average concentrations as a function of wind direction were compared and the maximum values summarized in Table 5.1-2-12.

TABLE 5.1.2-7

SUMMARY OF ONSITE AIR QUALITY FOR THE SPRING 1975 MONITORING PERIOD TRIMBLE COUNTY GENERATING PLANT

Pollutant	Averaging Interval	Secondary Standard ($\mu g/m^3$)	Observed Concentration ($\mu g/m^3$)			Data Collection Efficiency (%)
			Wises Landing	Willis	Jones	
Sulfur Dioxide	3-Hour Maximum	1,300	180	268	120	93.8
	24-Hour Maximum	365[a]	66	113	71	
	Annual Arithmetic Mean	60	29	55	55	
Particulates	24-Hour Maximum	150	103	112	123	
	Annual Geometric Mean	60	54	70	78	
(Number of 24-Hour Samples)			(30)	(10)	(8)	
Nitrogen Oxides[b]	Annual Arithmetic Mean	100[c]	26	30	30	95.6
Carbon Monoxide	1-Hour Maximum	10,000[c]	3,971	2,233	1,506	82.6
	8-Hour Maximum	40,000[c]	1,751	1,482	1,257	
Nonmethane Hydrocarbons	3-Hour Maximum (6-9 a.m.)	160[c]	549	560	588	81.3
Photochemical Oxidants	1-Hour Maximum	160[c]	212	336	181	95.5
Hydrogen Sulfide	1-Hour Maximum	14	Below detectable limit of 0.0001 ppm or 0.08 $\mu g/m^3$			

---

[a] Primary standard.

[b] NO_2+NO

[c] Same as primary standard.

TABLE 5.1.2-8

SUMMARY OF ONSITE AIR QUALITY FOR THE SUMMER 1975 MONITORING PERIOD TRIMBLE COUNTY GENERATING PLANT

			Observed Concentration (µg/m^3)				
Pollutant	**Averaging Interval**	**Secondary Standard (µg/m^3)**	**Wises Landing**	**Willis**	**Jones**	**Wentworth**	**Data Collection Efficiency (%)**
Sulfur Dioxide	3-Hour Maximum	1,300	162	134	92	136	93.4
	24-Hour Maximum	365[a]	71	68	44	58	
	Annual Arithmetic Mean	60	24	34	21	29	
Particulates	24-Hour Maximum	150	60	78	63	86	
	Annual Geometric Mean	60	46	57	54	60	
(Number of 24-Hour Samples)			(16)	(10)	(9)	(12)	
Nitrogen Oxides	Annual Arithmetic Mean	100[b]	22	22	34	28	87.8
Carbon Monoxide	1-Hour Maximum	10,000[b]	1,622	670	1,187	645	73.4
	8-Hour Maximum	40,000[b]	1,383	536	850	476	
Nonmethane Hydrocarbons	3-Hour Maximum (6-9 a.m.)	160[b]	2,319	641	45	598	73.3
Photochemical Oxidants	1-Hour Maximum	160[b]	228	145	245	122	91.1
Hydrogen Sulfide	1-Hour Maximum	14	Not Sampled (refer to text)				

---

[a] Primary standard.

[b] Same as primary standard.

TABLE 5.1.2-9

SUMMARY OF ONSITE AIR QUALITY FOR THE AUTUMN 1975 MONITORING PERIOD
TRIMBLE COUNTY GENERATING PLANT

Pollutant	Averaging Interval	Secondary Standard ($\mu g/m^3$)	Observed Concentration ($\mu g/m^3$)			Data Collection Efficiency (%)
			Wises Landing	Wentworth	Bedford	
Sulfur Dioxide	3-Hour Maximum	1,300	145	215	168	83.1
	24-Hour Maximum	365[a]	65	57	69	
	Annual Arithmetic Mean	60	24	26	39	
Particulates	24-Hour Maximum	150	84	41	103	
	Annual Geometric Mean	60	43	31	66	
(Number of 24-Hour Samples)			(14)	(5)	(8)	
Nitrogen Oxides	Annual Arithmetic Mean	100[b]	50	48	64	94.2
Carbon Monoxides	1-Hour Maximum	10,000[b]	3,323	802	5,014	75.7
	8-Hour Maximum	40,000[b]	1,485	660	2,114	
Nonmethane Hydrocarbons	3-Hour Maximum (6-9 a.m.)	160[b]	542	1,012	1,095	73.4
Photochemical Oxidants	1-Hour Maximum	160[b]	258	156	214	89.2
Hydrogen Sulfide	1-Hour Maximum	14	Not Sampled (refer to text)			

---

[a] Primary standard.

[b] Same as primary standard.

TABLE 5.1.2-10

SUMMARY OF ONSITE AIR QUALITY FOR THE WINTER 1975 MONITORING PERIOD
TRIMBLE COUNTY GENERATING PLANT

			Observed Concentration ($\mu g/m^3$)			
Pollutant	Averaging Interval	Secondary Standard ($\mu g/m^3$)	Wises Landing	Wentworth	Bedford	Data Collection Efficiency (%)
Sulfur Dioxide	3-Hour Maximum	1,300	253	189	331	97.0
	24-Hour Maximum	365[a]	80	74	112	
	Annual Arithmetic Mean	60	29	37	42	
Particulates	24-Hour Maximum	150	49	60	95	
	Annual Geometric Mean	60	31	34	41	
(Number of 24-Hour Samples)						
Nitrogen Oxides[b]	Annual Arithmetic Mean	100[c]	94	42	88	85.6
Carbon Monoxide	1-Hour Maximum	10,000[c]	5,389	751	1,421	85.5
	8-Hour Maximum	40,000[c]	2,052	461	716	
Nonmethane Hydrocarbons	3-Hour Maximum (6-9 a.m.)	160[c]	641	376	2,017	80.1
Photochemical Oxidants	1-Hour Maximum	160[c]	371	228	130	97.7
Hydrogen Sulfide	1-Hour Maximum	14	Not Sampled (Refer to Text)			

---

[a] Primary standard.

[b] NO_2+NO

[c] Same as primary standard.

TABLE 5.1.2-11

SUMMARY OF ONSITE AIR QUALITY FOR THE SPRING, SUMMER, AUTUMN, AND WINTER 1975 MONITORING PERIODS
TRIMBLE COUNTY GENERATING PLANT

Pollutant	Averaging Interval	Secondary Standard ($\mu g/m^3$)	Observed Concentration ($\mu g/m^3$)					Data Collection Efficiency (%
			Wises Landing	Willis	Jones	Wentworth	Bedford	
Sulfur Dioxide	3-Hour Maximum	1,300	253	267	121	215	331	92.4
	24-Hour Maximum	365[a]	80	113	71	74	112	
	Annual Arithmetic Mean	60	26	44	29	31	42	
Particulates	24-Hour Maximum	150	103	112	123	86	103	
	Annual Geometric Mean	60	41	57	54	44	50	
(Number of 24-Hour Samples)								
Nitrogen Oxides	Annual Arithmetic Mean	100[b]	54	24	32	40	80	89.9
Carbon Monoxide	1-Hour Maximum	10,000[b]	5,390	2,240	1,510	802	5,010	79.8
	8-Hour Maximum	40,000[b]	2,050	1,480	1,260	660	2,120	
Nonmethane Hydrocarbons	3-Hour Maximum (6-9 a.m.)	160[b]	2,320	641	588	1,010	2,020	77.2
Photochemical Oxidants	1-Hour Maximum	160[b]	279	336	245	228	214	93.8
Hydrogen Sulfide	1-Hour Maximum	14	Below detectable limit of 0.0001 ppm or 0.08 $\mu g/m^3$					

---

[a] Primary standard.

[b] Same as primary standard.

TABLE 5.1.2-12

MAXIMUM DIRECTIONAL AVERAGE SULFUR DIOXIDE CONCENTRATION TRIMBLE COUNTY GENERATING PLANT

	Monitoring Location				
	Wises Landing	Willis	Jones	Wentworth	Bedford
Approximate Direction to Clifty Creek Plant	N	N	N	NNW	NNW
SPRING					
Wind Direction[a]	SSW	SSW	NW	-	-
Directional Average (μg/m^3)	41	67	82	-	-
Number of 15-Minute Averages	129	123	11	-	-
Prevailing Direction for monitoring period	SSE	E	S	-	-
SUMMER					
Wind Direction[a]	W	ENE	SW	NE	-
Directional Average (μg/m^3)	31	52	29	39	-
Number of 15-Minute Averages	116	92	95	53	
Prevailing Direction for monitoring period	WNW	NNW	NNW	N	-
AUTUMN					
Wind Direction[a]	SSW	-	-	S	S
Directional Average (μg/m^3)	66	-	-	41	55
Number of 15-Minute Averages	106	-	-	106	160
Prevailing Direction for monitoring period	N	-	-	SSW	SSW
WINTER					
Wind Direction[a]	S	-	-	NW	NW
Directional Average (μg/m^3)	43	-	-	69	83
Number of 15-Minute Averages	411	-	-	13	62
Prevailing Direction for monitoring period	SSE	-	-	SSE	S

---

[a] Associated with maximum SO_2 concentration.

Despite the number of periods in which northerly winds prevailed, sulfur dioxide emissions from the Clifty Creek plant did not cause high concentrations on or near the Trimble County site. Onsite sulfur dioxide concentrations seem to be affected by more distant sources to the south and west in the vicinity of Louisville.

Particulates

Onsite total suspended particulate concentrations were similar to values obtained by Kentucky and Indiana. Geometric mean concentrations for the sampling period ranged from approximately 45 to 55 μg/m^3. The higher concentrations observed during the spring sampling period were anticipated because plowing and planting activities on onsite and nearby agricultural land create considerable amounts of airborne particulates. While the overall sampling period was relatively short, a total of 161 (24-hour) samples were collected, which, it is felt, lend confidence to the summarizations.

Nitrogen Oxides

Like sulfur dioxide concentrations, the average oxides of nitrogen concentrations were slightly higher than those observed at Kentucky and Indiana monitoring stations. Average concentrations (which range from 20 to 80 μg/m^3) were below the standard (100 μg/m^3). The relatively high average concentrations observed at Bedford were probably a function of the proximity to residential, commercial, and vehicular sources in the downtown area.

Photochemical Oxidants

In every monitoring period, photochemical oxidant concentrations frequently exceeded the 1-hour standard (160 μg/m^3). The highest concentration was 336 μg/m^3.

Carbon Monoxide

As is typical of rural locations with little vehicular traffic, carbon monoxide concentrations were consistently well below both the 1-hour (40,000 μg/m^3) and 8-hour (10,000 μg/m^3) standards. The maximum observed 1-hour average concentration was 5,390 μg/m^3, and the maximum 8-hour average concentration was 2,050 μg/m^3.

Nonmethane Hydrocarbons

With the exception of the summer monitoring period at the Jones monitoring location, nonmethane hydrocarbon concentrations were in excess of the standard (160 $\mu g/m^3$) at each monitoring location and during each sampling period. The maximum observed concentration was 2,320 ug/m^3 at the Wises Landing site.

Summary of Onsite Air Quality

While a longer sampling period would have been desirable, these data indicate that sulfur dioxide, particulate, and nitrogen oxide concentrations on and in the vicinity of the proposed plant site are below secondary standards and are consistent with concentrations reported by Indiana and Kentucky. Carbon monoxide concentrations are very low and typical of rural areas. Photochemical oxidant and nonmethane hydrocarbon concentrations are, however, frequently in excess of the standards. Hydrogen sulfide concentrations were below detectable limits.

5.1.3 Ambient Noise Levels

Measurement Procedures

The range of sound pressures detected by the human ear varies from 2×10^{-10} atmospheres at the threshold of hearing to 2×10^{-3} atmospheres for sounds which are so loud as to be painful. But because the use of atmospheres to describe sound is awkward, sound levels are generally expressed in terms of the decibel (dB), which is the logarithm of the observed sound pressure level to the sound pressure level at the threshold of hearing.

The human ear does not respond to sounds of different frequencies in a uniform manner. Instead, sounds at a low frequency do not seem as loud as those with equal intensity but a higher frequency. To account for this, the A-weighting system was devised to simulate the response of the human ear. A-weighted sound levels are expressed in dB(A) and are used to evaluate hearing damage risk and community annoyance impact.

In order to provide baseline environmental noise data, a survey was made of the existing noise levels at the site during the 3-day period 28 through 30 April 1975. Monitoring was conducted at six locations (shown in Figure 5.1.3-1), which were selected on the basis of several considerations. Locations near residences would be indicative of human activity near inhabited areas. For similar reasons, locations selected near the river and road would provide data on water and road transportation noise. Because the site was rural, some locations away from known human activity were selected. The monitoring locations were all selected to provide data which best characterize the ambient noise environment of the proposed power plant site.

Measurements were made with the equipment outlined in Appendix V. At two of the locations (PX1 and PX2), sound levels were monitered continuously for a total period of 40 hours to determine diurnal variations.

The system used to provide continuous measurements was a self-contained, battery-powered, sound monitoring device that observed the A-weighted sound level eight times per second, computed a statistical distribution of such sound levels, and at the end of each hour, recorded that distribution on a digital tape recorder. The digital recording was subsequently reproduced into a conventional digital computer for analysis.

Periodic measurements were conducted manually at five other locations to determine an octave band sound level (sound levels for each octave band with center frequencies 31.5; 63; 125; 250; 500; 1,000; 2,000; 4,000; and 8,000 Hertz) spectrum characteristic of the proposed site area and to provide supportive information on ambient A-weighted sound levels.

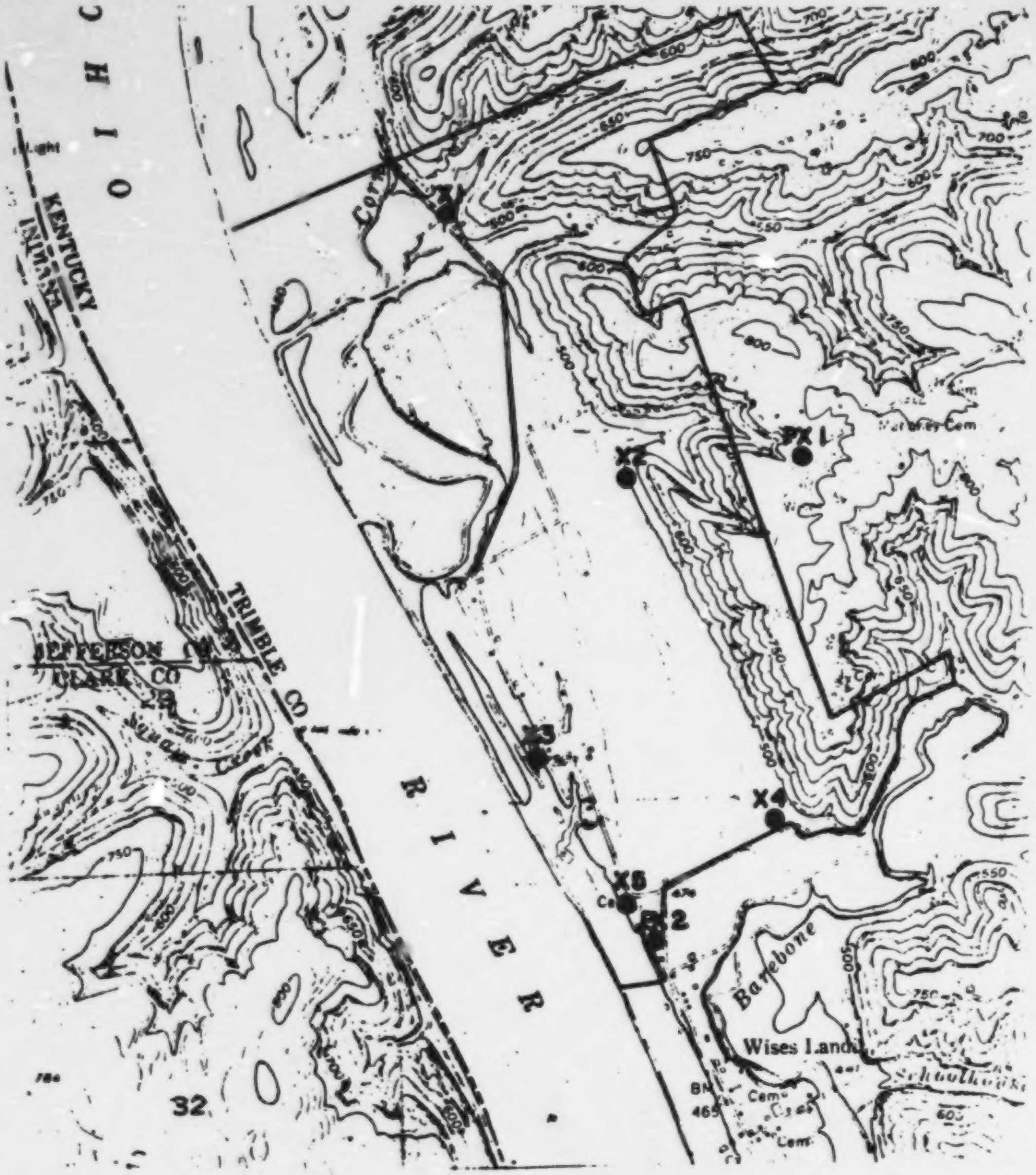
Results of Measurements

In general, audible noise sources observed at the site can be divided into two categories:

1. Background noise levels from natural sources (birds, insects, wind in trees) and some distant, lower-level, man-made sources
2. Special event noises caused by river barge traffic, aircraft flyover, and local highway traffic

During the measurement period, high water levels hindered dredging activities. However, diesel noise from a dredge moored in the Ohio River was later judged to be significant. Although quantitative estimates of the dredge's effect on ambient sound levels are not available, it is considered to be a temporary source. Additionally, percussion from an artillery firing range was noted during a site visit.

During the monitoring period, the L_{90} (that noise level exceeded 90 percent of the time and often used to represent the "background ambient" noise level) ranged from 30 to 40 dB(A) during the day and 25 to 30 db(A) at night. These relatively low levels are indicative of rural, sparsely populated areas. The L_{10} (which represents "intrusive noise" levels) ranged from approximately 55 to 60 dB(A) during the night to between 65 and 70 dB(A) during the day. The octave sound levels describing the background noise environment have been separated into daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) groups. The ranges of octave band data in these two groups are shown in Figures 5.1.3-2 and 5.1.3-3. These figures show the typical daytime and nighttime background octave band noise levels encountered around the site (hatched area).


O H I O
R I V E R
KENTUCKY
INDIANA
TRIMBLE CO
JEFFERSON CO
CLARK CO
PX 1
PX 2
X2
X3
X4
X5
Barebone
Wises Landing
Schoolhouse
32
750
700
600
800
550
BM 465
Cem

POINTS PX 1 & PX 2 24 HOUR CONTINUOUS READINGS

POINTS X1 – X5 15-20 MINUTE READINGS TAKEN EVERY 2-3 HOURS

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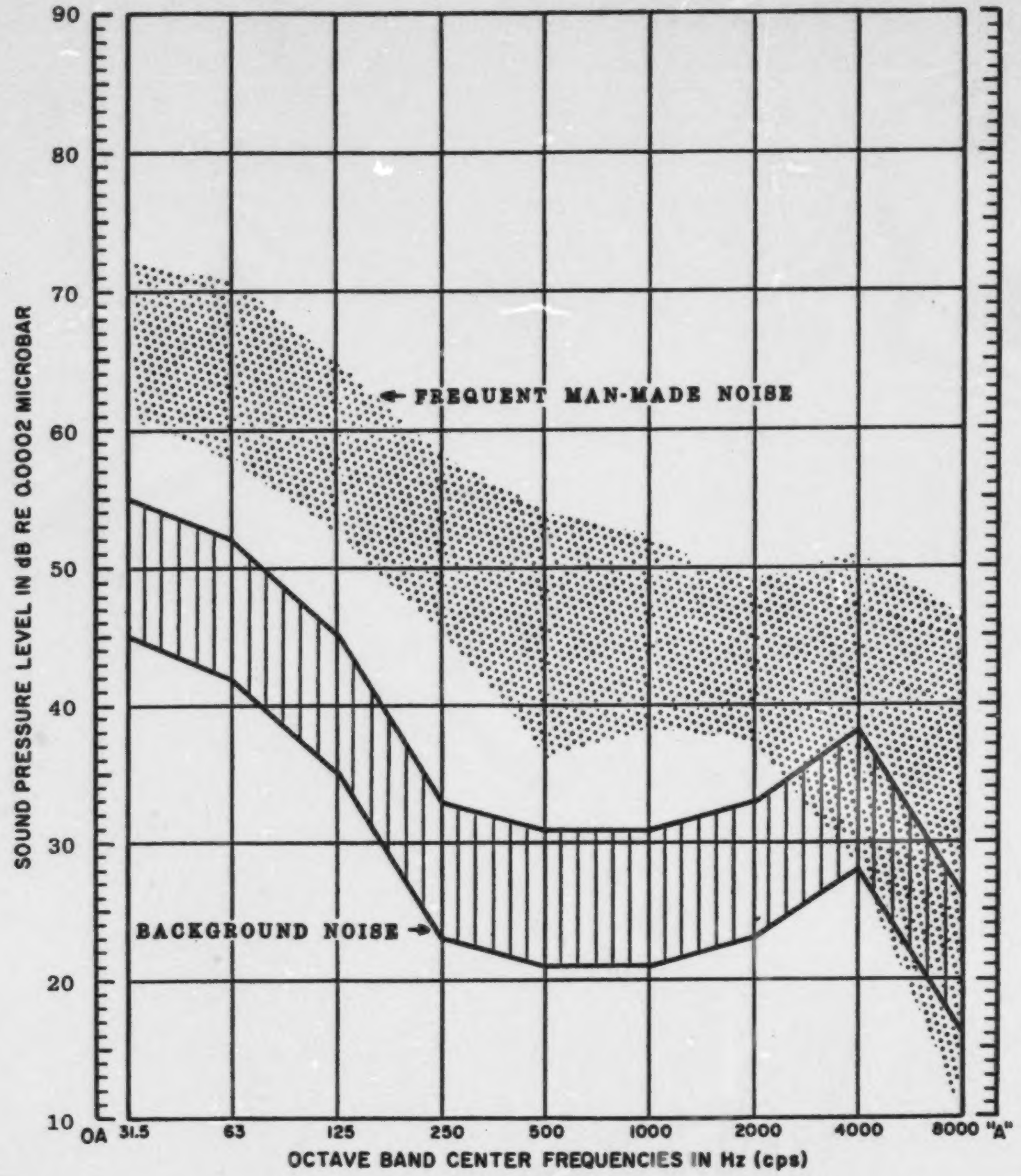
TRIMBLE COUNTY GENERATING PLANT

AMBIENT NOISE SURVEY STATIONS

FIGURE 5.1.3-1

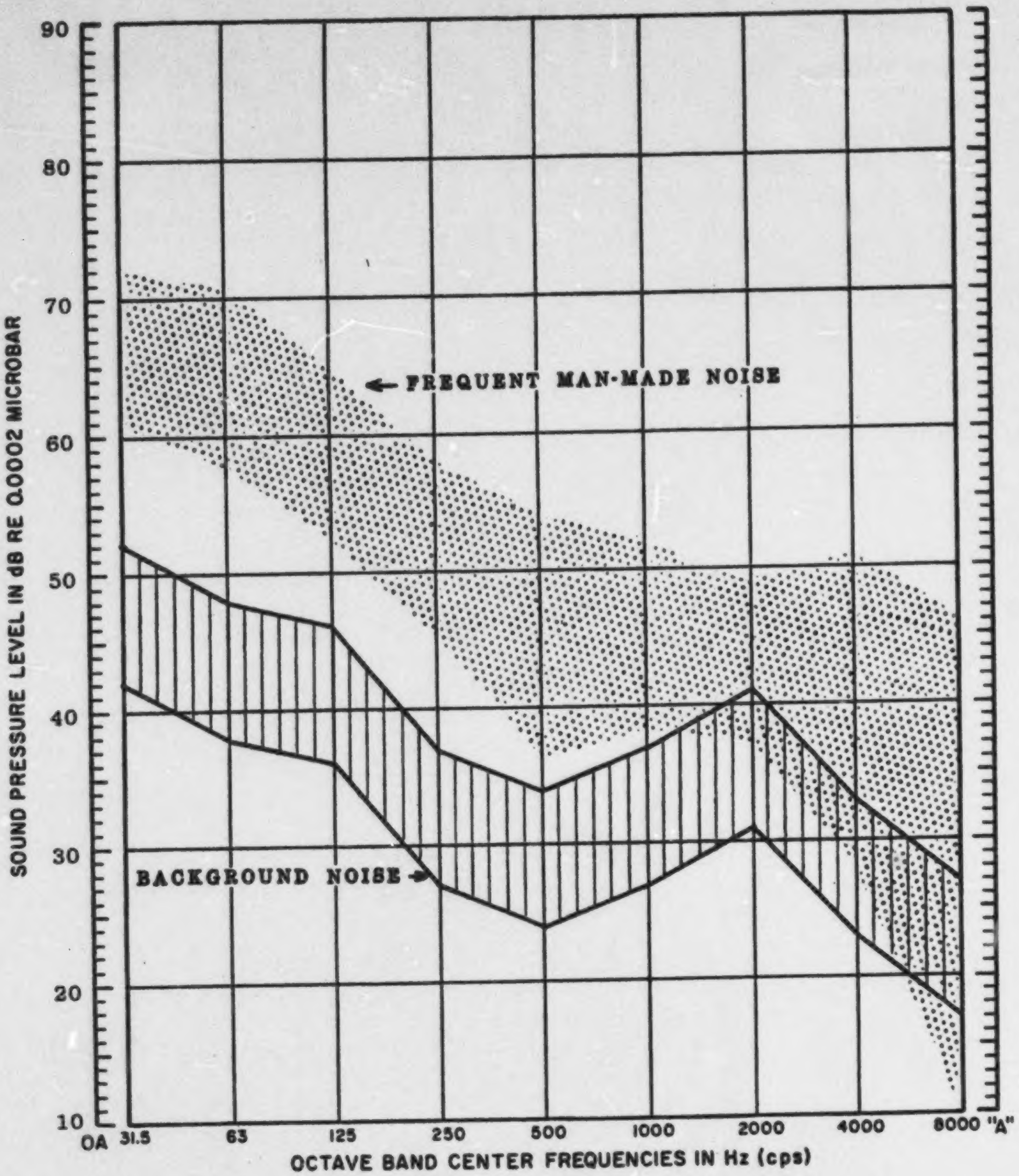


Source: Bolt, Beranek, and
Neuman, 1975

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

TYPICAL DAYTIME SOUND LEVEL

FIGURE 5.1.3-2



LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

TYPICAL NIGHTTIME SOUND LEVEL

FIGURE 5.1.3-3

Source: Bolt, Beranek, and Neuman, 1975

They also represent, by the dotted field, the typical range of higher noise levels due to frequent man-made noise occurrences.

During the measurement period, background A-weighted sound levels were dominated by bird and insect noise, with barge, auto, and aircraft passage occasionally producing higher, intrusive sound levels. The data also indicate that sound levels near the Ohio River and Wises Landing are higher by approximately 10 dB than at locations farther from the site due to the influence of river and highway traffic.

5.2 LAND

The following discussion of the land components of the environment likely to be affected by the proposed project is generally divided into a consideration of the areas to be affected by the plant and its operations (the plant site and adjacent ravines) and by the transmission lines (Kentucky transmission line corridor and Indiana preliminary transmission line corridor).

5.2.1 Physiography and Topography

Plant Site and Ravines

The plant site is located at the northern edge of the Interior Low Plateau physiographic province and within the Outer Bluegrass Subsection of the Bluegrass Region of northern Kentucky (see Section 2.2.1 for a description of regional physiography and topography). The Highland Rim Section lies immediately to the west of the plant site, encompassing southern Indiana and portions of western Kentucky. To the north of the plant site lies the Central Lowlands physiographic province (see Section 2.2.1).

Most of the site is on a level or gently sloping flood plain of the Ohio River; the remainder consists of steeply sloping, 300- to 400-foot-high bluffs. An outwash terrace and a modern alluvial plain along the river banks, as shown on Figure 5.2.1-1, comprise the flood plain. The alluvium is relatively featureless, approximately 100 feet thick, and deposited on bedrock that is a subsurface extension of the valley slopes. The uplands or plateau to the east of the site varies from gently rolling with some dissection to a sharper, highly dissected landscape. Some gullying has taken place, and the larger streams show signs of rejuvenation. The uplands are in an early to mid-mature stage of development and show numerous signs of karstic topography, including sinkholes, numerous springs, and disappearing streams.

The flood plain elevation ranges from 420 to about 470 feet above mean sea level, with the higher elevations at the bankside levees and along the base of the bluffs. The bluffs reach a maximum elevation of over 800 feet, with relief of 350 to 400 feet. The river is approximately 2,000 feet wide, with a variable depth to 35 feet that is at an elevation of about 385 feet at its deepest point.

Preliminary Transmission Line Corridor (Indiana)[a]

From the Ohio River valley, the route passes across four geologic environments. The topography of most of the preliminary corridor is nearly flat. Sedimentary strata dip imperceptibly westward beneath a surficial blanket of glacial till that covers most of the region.

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[a] Information on the plant site and ravines is applicable to the Kentucky transmission line corridor.

5.2.2 Geologic Setting

Stratigraphy

Plant Site and Ravines

Unconsolidated sediments of the Ohio River valley include granular glacial outwash deposits that overlie the bedrock channel and a thin mantle of fine-grained alluvium that blankets the surface of the flood plain.

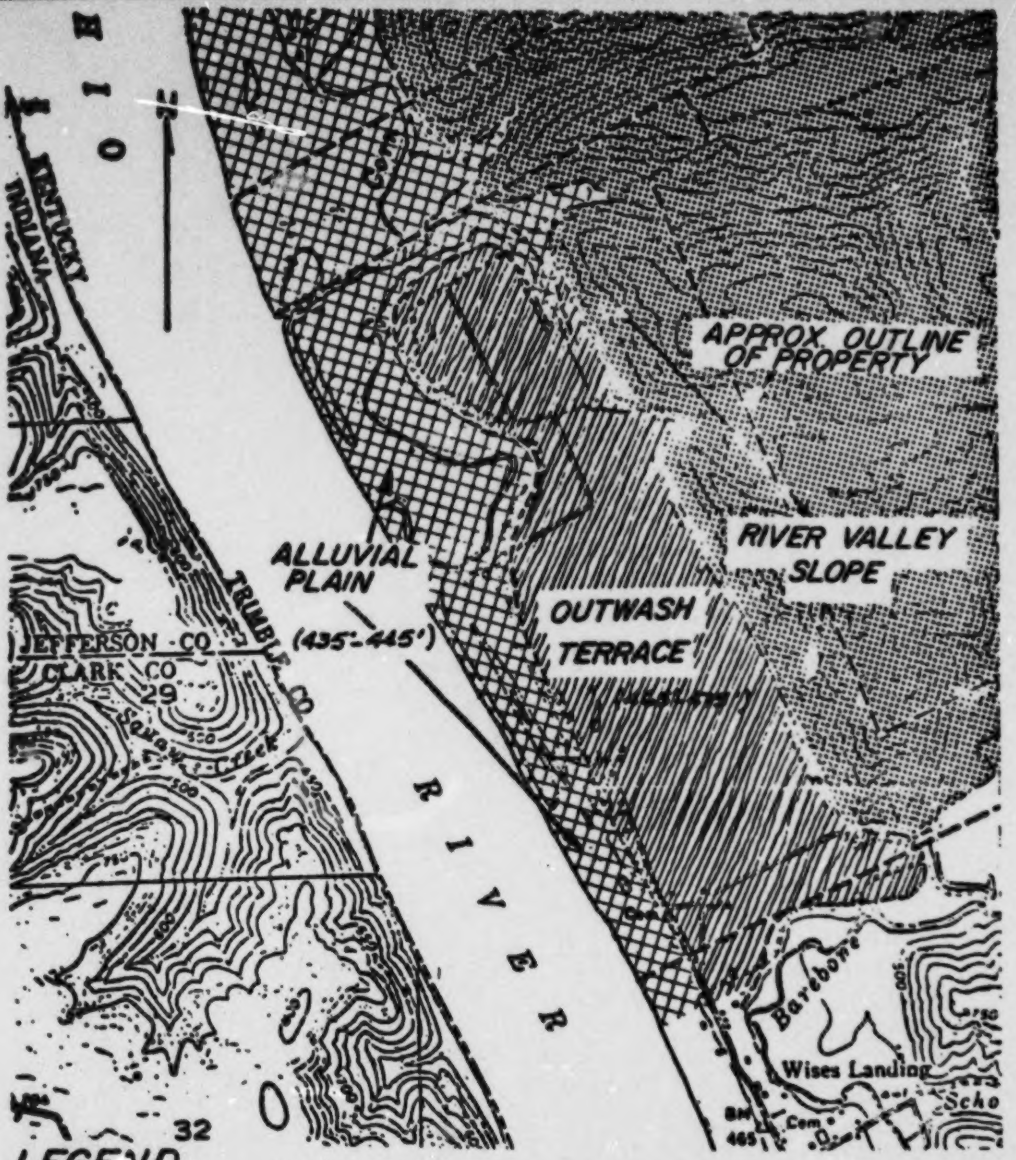
The Holocene (Recent) age layer of surficial alluvium ranges in composition from brown, sandy silt to silty clay. The alluvium is generally from 6 to 15 feet thick throughout the upper terrace of the flood plain, although it is up to 40 feet thick at the bank of the Ohio River. The Holocene alluvium has been deposited on the flood plain as a result of floods since the Wisconsin Glacial Stage.

Underlying the Holocene alluvium is a thick wedge of coarse-grained glacial outwash deposits; the thickness of the deposits ranges from zero at the eastern valley wall to over 120 feet in central portions of the flood plain. The top of the outwash generally lies between elevations 450 and 465 throughout the upper terrace area. Adjacent to the Ohio River, the outwash begins at elevation 440 in the center of the property but falls off to about elevation 405 to the north and south of the subsurface high spot.

The glacial outwash deposits are typically composed of fine- to coarse-grained sand often containing some gravel or cobbles in varying proportions. The base of the outwash deposit is usually marked by a bed of large boulders and cobbles just above the top of bedrock. Preliminary borings indicate that the top of bedrock varies from elevation 327 to 342 under most of the site occupied by the flood plain, beyond the slope of the valley wall. A generalized subsurface cross section through the central portion of the site area is shown on Figure 5.2.2-1.

Two ravines, RA and RB, extend eastward from the river bluff at the northern portion of the site. Preliminary borings indicate that the bottom of each ravine contains a blanket of soil from 30 to 37 feet thick and that the top of bedrock is near elevation 405 at the mouth of each ravine. Soils within 5 to 15 feet of the ground surface are described as silts and clays with variable amounts of sand and gravel. Below the surficial material, a gray clayey silt soil of medium stiff consistency was encountered by the preliminary borings. The presence of organic material within the clayey silt stratum suggests a glacial lacustrine origin of the deposit.

Bedrock units immediately underlying the plant site consist of sedimentary strata ranging in age from Middle Silurian to Upper Ordovician. The areal extent of these upper bedrock units is shown on the Geologic Map of Trimble County, Kentucky, Figure 5.2.2-2. The stratigraphic description of bedrock units is given on the Geologic Column, Figure 5.2.2-3.


OHIO
KENTUCKY
INDIANA
APPROX. OUTLINE OF PROPERTY
RIVER VALLEY SLOPE
ALLUVIAL PLAIN
(435'-445')
OUTWASH TERRACE
TRIMBLE CO
JEFFERSON CO
CLARK CO
29
RIVER
Barebone
Wises Landing
Scho
BM 445
32

LEGEND

▩ ALLUVIAL PLAIN—SILTY & CLAYEY SANDS, CLAYEY SILTS

▨ OUTWASH TERRACE—SILTY & CLAYEY SANDS, CLAYEY SILTS WITH VERY COARSE-GRAINED STRINGERS

▦ RIVER VALLEY SLOPE—RESIDUAL RED SILTY CLAYS

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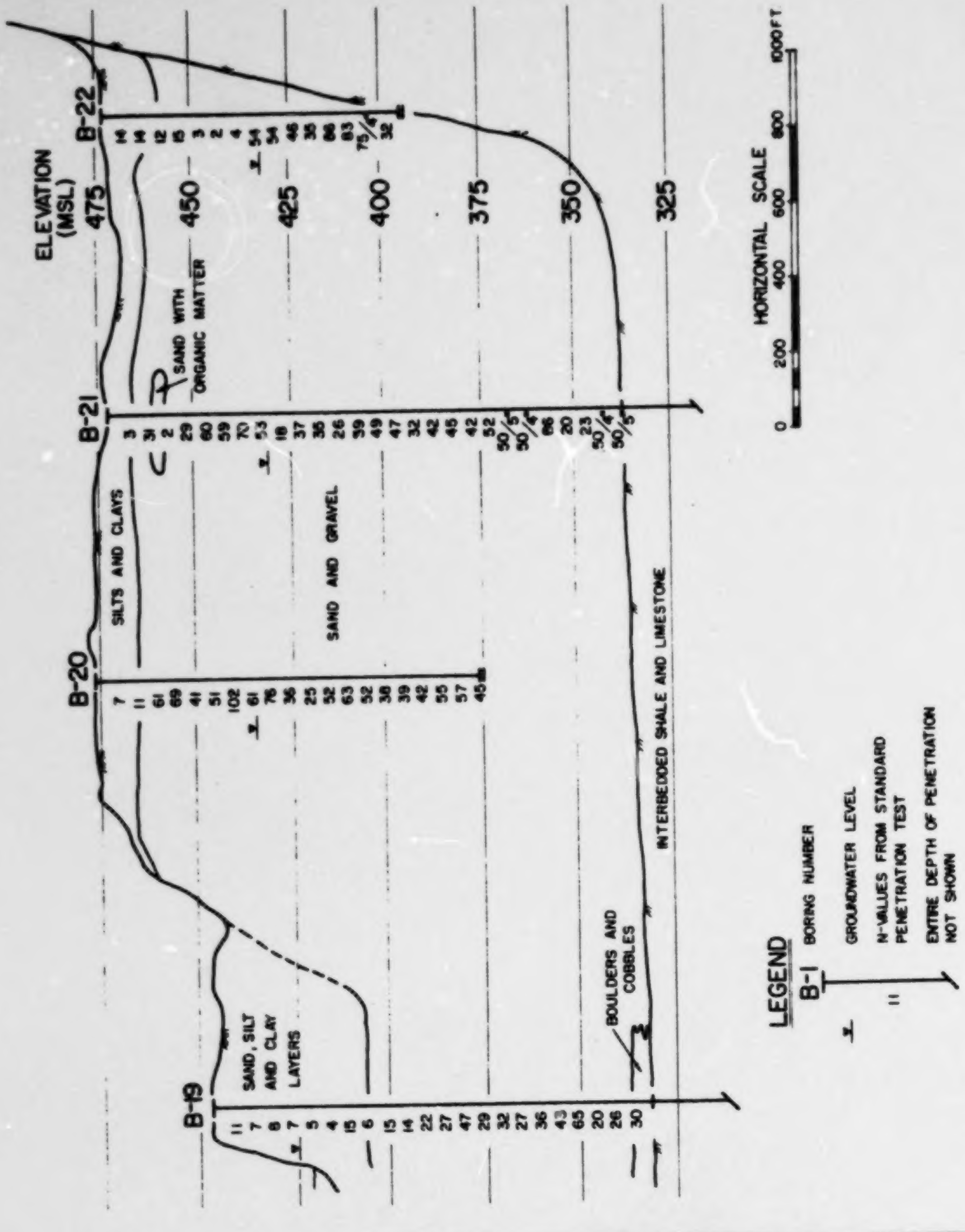
SURFICIAL DEPOSITS

Source: Fluor Pioneer Inc., 1975

FIGURE 5.2.1-1

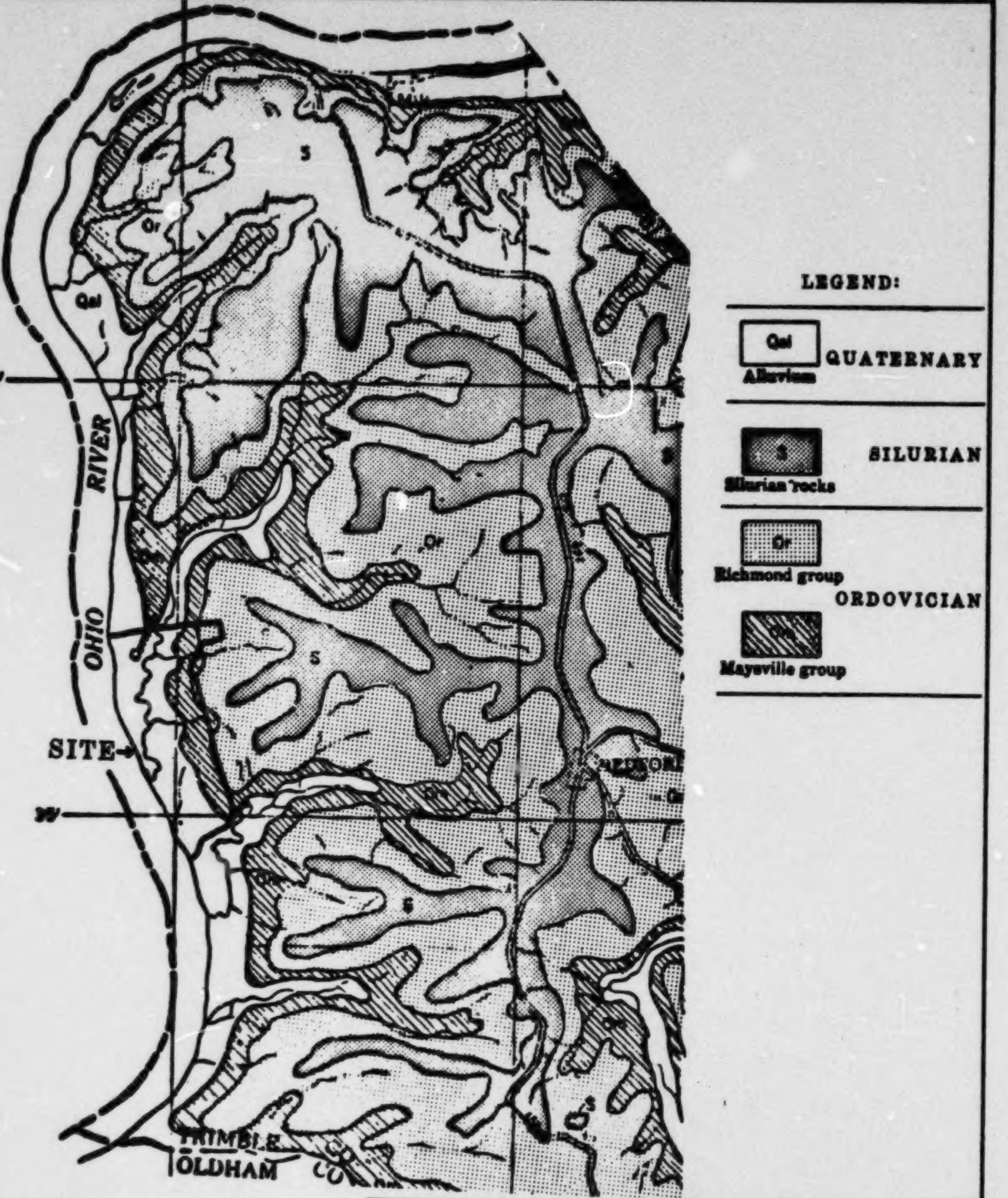

ELEVATION (MSL)
475
450
425
400
375
350
325
B-22
14 14 12 15 3 2 4 34 54 46 35 66 83 75/4 32
B-21
3 31 2 29 60 59 70 53 18 37 35 26 39 49 47 32 42 45 42 52 50/5 50/4 66 20 23 50/4 50/5
B-20
7 11 61 69 41 51 102 61 76 36 25 52 63 52 38 39 42 55 57 45
B-19
11 7 8 7 5 4 15 6 15 14 22 27 47 29 32 27 36 43 65 20 28 30
SAND WITH ORGANIC MATTER
SILTS AND CLAYS
SAND AND GRAVEL
INTERBEDDED SHALE AND LIMESTONE
SAND, SILT AND CLAY LAYERS
BOULDERS AND COBBLES
HORIZONTAL SCALE
0 200 400 600 800 1000FT
LEGEND
B-1 BORING NUMBER
GROUNDWATER LEVEL
11 N-VALUES FROM STANDARD PENETRATION TEST
ENTIRE DEPTH OF PENETRATION NOT SHOWN

Source:
Derived From
Atec Associates, 1975

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

GENERALIZED SOIL PROFILE OF CENTRAL SITE AREA

FIGURE 5.2.2-1

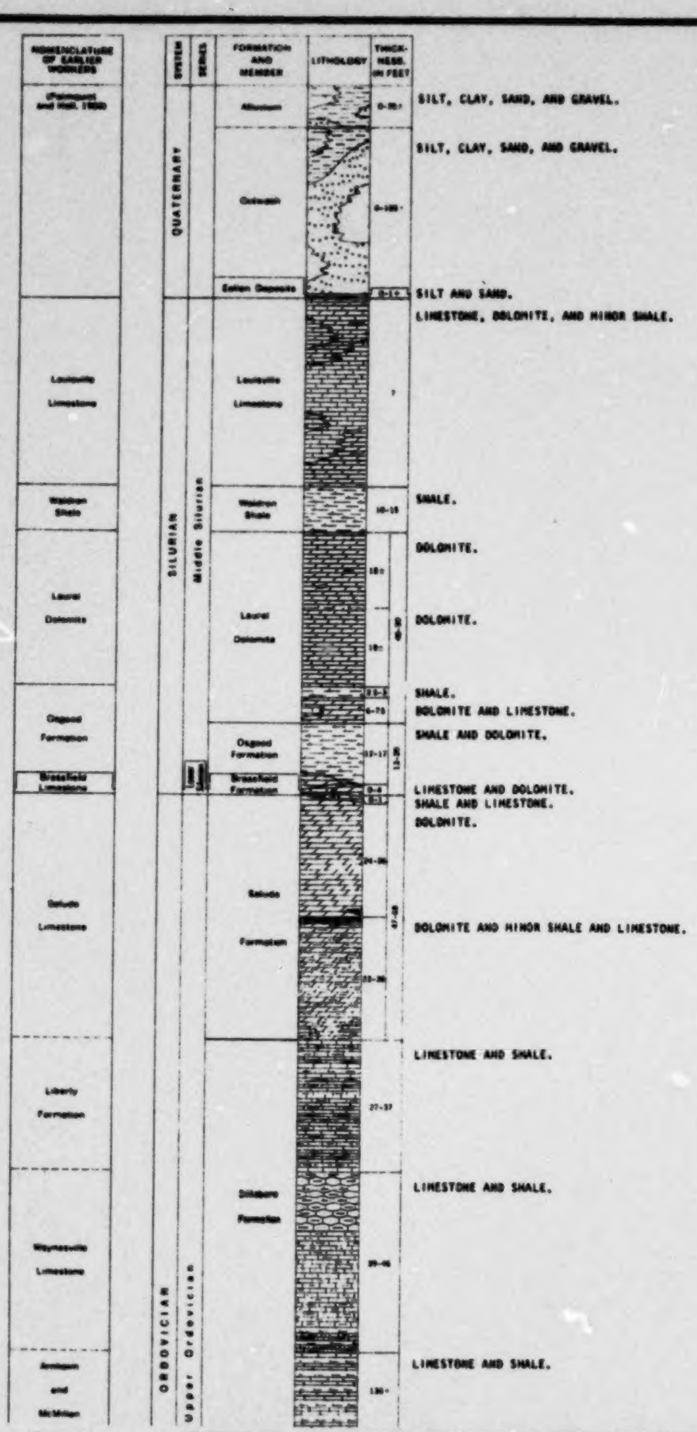

LEGEND:
Qal
Alluvium
QUATERNARY
S
Silurian rocks
SILURIAN
Or
Richmond group
ORDOVICIAN
Om
Maysville group
Qal
S
Or
40'
RIVER
OHIO
SITE→
35'
TRIMBLE
OLDHAM
CO

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

GEOLOGIC MAP OF TRIMBLE COUNTY

FIGURE 5.2.2-2

Source: Fluor Pioneer Inc., 1975


NOMENCLATURE OF EARLIER WORKERS
SYSTEM
SERIES
FORMATION AND MEMBER
LITHOLOGY
THICKNESS IN FEET
QUATERNARY
SILURIAN
Middle Silurian
ORDOVICIAN
Upper Ordovician
Alluvium
Outwash
Eolian Deposits
Louisville Limestone
Waldron Shale
Laurel Dolomite
Osgood Formation
Brassfield Limestone
Brassfield Formation
Saluda Limestone
Saluda Formation
Liberty Formation
Waynesville Limestone
Dillsboro Formation
Arnheim and McMillan Formations
10-15
18±
18±
6-7½
12-17
0-4
24-36
33-36
27-37
39-46
130+
SILT, CLAY, SAND, AND GRAVEL.
SILT, CLAY, SAND, AND GRAVEL.
SILT AND SAND.
LIMESTONE, DOLOMITE, AND MINOR SHALE.
SHALE.
DOLOMITE.
DOLOMITE.
SHALE.
DOLOMITE AND LIMESTONE.
SHALE AND DOLOMITE.
LIMESTONE AND DOLOMITE.
SHALE AND LIMESTONE.
DOLOMITE.
DOLOMITE AND MINOR SHALE AND LIMESTONE.
LIMESTONE AND SHALE.
LIMESTONE AND SHALE.
LIMESTONE AND SHALE.

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

SITE GEOLOGIC COLUMN

FIGURE 5.2.2-3

Silurian strata occur over most of the upland areas and are the youngest bedrock formations on the plant site. These strata are principally composed of limestone and dolomite formations, interbedded with shale members that are generally less than 15 feet thick. The areal extent of Silurian strata on the site is limited to a very small fringe on the eastern property boundary. As interpreted from the lower limit of karstic development shown on a detailed topographic map of the plant site, the base of Silurian age formations occurs at approximately elevation 730 to 750. The base of Silurian strata has been found at about elevation 700 at the Marble Hill Nuclear Generating Station site, almost directly across the Ohio River from the Trimble County Generating Plant site.

Strata of Upper Ordovician age form bedrock units throughout most of the plant site. Directly below the Silurian contact is the Saluda Formation, a thinly bedded dolomite unit about 63 feet thick. The Saluda Formation is underlain by the Dillsboro Formation, a thick sequence of limestone and dolomite interbedded with shale. Most of the carbonate beds are thin, rather coarsely crystalline, and contain numerous fossils. Upper Ordovician strata, collectively known as the Richmond Group (below the Saluda Formation), and the underlying Maysville Group are both included in the Dillsboro sequence.

The Dillsboro Formation extends from approximately elevation 680 to far below the flood plain and bedrock channel of the Ohio River buried valley.

The Kope Formation (or Eden shale) underlies the Dillsboro Formation at depth and is the lowest unit of the Upper Ordovician Series. The Kope Formation does not outcrop on the site, although it is present at depth. Middle Ordovician, Lower Ordovician, and Cambrian strata also occupy the subsurface domain above the Precambrian basement surface.

Preliminary Transmission Line Corridor (Indiana)[a]

The eastward portion of the preliminary corridor will cross the Ohio River alluvial plain. This flood plain area is usually filled with sand and gravel outwash, which is up to 100 feet thick in places. At the surface of the flood plain, a blanket of silty clay usually overlies the coarse outwash materials.

Thinly bedded limestone and shale strata of Late Ordovician age underlie the Ohio River alluvial plain and outcrop along the valley walls. The individual limestone beds are rarely over 3 feet thick and are encased in beds of hard shale. The Ohio River valley walls, particularly the lower part, may be covered by a mantle of colluvial soils, which are derived from the weathering and downslope movement of the parent Ordovician strata.

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[a] Information on the plant site and ravines is applicable to the Kentucky transmission line corridor.

From the upper hill slopes of the Ohio River valley wall to about 2 miles east of New Washington, Indiana, the preliminary corridor will cross a zone of Silurian age strata composed mostly of limestone or dolomite, with some minor shale beds. These Silurian strata reach a maximum thickness of 120 feet and directly overlie the Ordovician strata. The Silurian limestones are susceptible to solution activity that often results in cavities and shallow sinkholes in many areas. Sinkhole development is not extensive due to the presence of interbedded shale layers that inhibit free migration of ground water.

The western portion of the preliminary corridor is an area of Devonian age limestones and dolomite strata up to 90 feet thick. Similar to the underlying Silurian beds, Devonian age strata are also susceptible to a minor-to-moderate degree of solution activity. The outcrop belt of Devonian strata is broken only by the valley of Fourteen Mile Creek, where Silurian strata are again exposed.

The entire upland portion of the proposed route may contain a thin mantle of glacial till overlying the bedrock. This till layer is of the Illinoian Glacial stage and has a well developed soil profile because of its age. The till, often referred to as "hardpan," is composed of a dense, heterogeneous mixture of sand, gravel, silt, and clay.

Structure of the Plant Site, Ravines, and Transmission Line Corridors

No major geologic structures are known to exist in the vicinity of the plant site. The bedrock strata are nearly horizontal. The regional dip is toward the west, ranging from 20 to 50 feet per mile. Minor structures have been mapped in this area (Whitlach and Huddle, 1932) and consist of shallow, small anticlines and synclines.

Seismic History of the Plant Site, Ravines, and Transmission Line Corridors

The seismic history of the proposed power plant site region is characterized by a lack of damaging earthquakes in the area. Several earthquakes of Modified Mercalli Intensity V to VII (Table 5.2.2-1) with epicenters within 100 miles of the proposed site have been reported. The closest of these epicenters is related to the Maysville fault, which is considered to be seismically active. The Maysville fault is believed to be related to the Kentucky River fault, which runs east-west from central Kentucky to the West Virginia-Kentucky state line. The Maysville fault is estimated to be older than middle Tertiary in age.

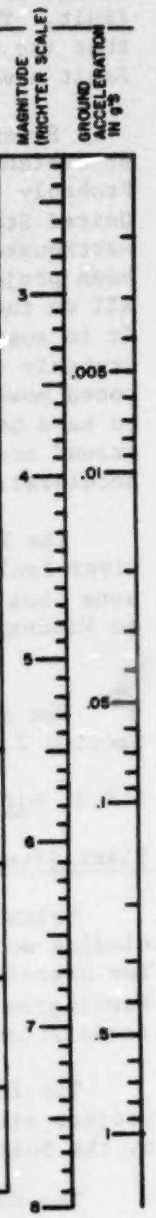
Several shocks have been reported in Maysville, Kentucky, about 90 miles east of the site. An earthquake in 1854 was of epicentral intensity VI. Earthquakes in 1869 and 1933 were of intensity V, and an earthquake in 1957 was of intensity III. These did not cause any significant

TABLE 5.2.2-1

MODIFIED MERCALLI INTENSITY SCALE
APPROXIMATE RELATIONSHIP WITH
MAGNITUDE AND GROUND ACCELERATION

Abridged Modified Mercalli Intensity Scale

I.	**Not felt except by a very few under especially favorable circumstances.**
II.	**Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.**
III.	**Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.**
IV.	**During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.**
V.	**Felt by nearly everyone; many awakened. Some dishes, windows, etc. broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.**
VI.	**Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.**
VII.	**Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures, considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.**
VIII.	**Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.**
IX.	**Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.**
X.	**Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations, ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.**



Modified Mercalli Intensity Scale after Wood and Neumann, 1931. (Intensities XI and XII not included.)

Magnitude and acceleration values taken from Nuclear Reactors and Earthquakes, TID-7024, United States Atomic Energy Commission.

damage near the epicenter on the southern extension of the Maysville fault. The low seismic activity of the fault is evidenced by the fact that the Quaternary and Tertiary sediments along the Kentucky River fault have not been shifted.

Several other earthquakes of greater intensity had their epicenters at distances greater than 150 miles from the proposed plant site. Probably the most severe earthquakes ever experienced in the northeastern United States were the New Madrid earthquakes of 1811-1812. From the earthquake reports in the Cincinnati area near the Ohio River, it has been projected that the earthquakes at the epicenters had an intensity of XII on the Modified Mercalli scale and a magnitude of 8 on the Richter scale. It is suspected that the intensity of the New Madrid earthquakes was probably the greatest earthquake intensity ever experienced by the proposed power plant site. The probable intensity at the site is estimated to have been almost V on the Modified Mercalli scale, corresponding to a ground acceleration at the site of approximately 2.4 percent of the acceleration of gravity.

The New Madrid earthquakes had their epicenters along the Mississippi River fault near the Mississippi Embayment. The Mississippi Valley fault zone begins at the Mississippi Embayment and extends northeast to Vincennes, Indiana. The fault is tectonically very active.

The above-mentioned faults are shown on the regional fault map in Section 2.2.2.

5.2.3 Surficial Soils

Plant Site and Ravines

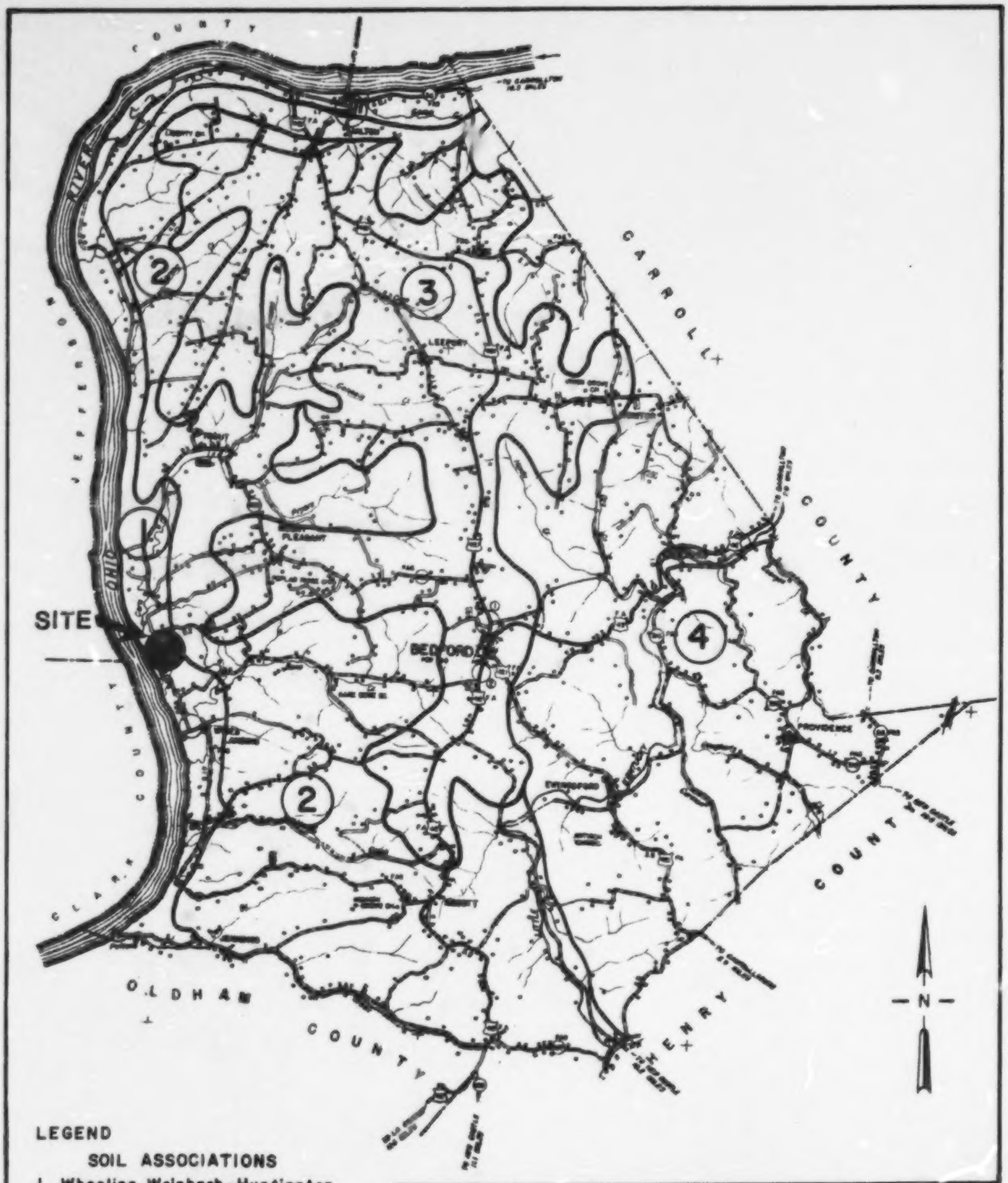
Trimble County is divided into four soil association areas, each including soils that occur together in a repeating pattern (Figure 5.2.3-1). Two associations exist on the project site--the Wheeling-Weinbach-Huntington Association (flood plain) and the Beasley-Mercer-Fairmount Association (uplands) (U.S. Department of Agriculture, 1971).

The following is a general discussion of the two soil types on the project site; it is based on the most detailed data obtained to date by the Soil Conservation Service (U.S. Department of Agriculture, 1971).

The Wheeling-Weinbach-Huntington Association occupies about 7 percent of the county. The association is composed as follows:

Wheeling soils - 30%
Weinbach soils - 22%
Huntington soils - 20%
Minor soils - 28%

Minor soils are the Newark, the Sciotoville, and the Larkin soils.


COUNTY
CARROLL
COUNTY
HENRY
COUNTY
OLDHAM
COUNTY
CLARK
COUNTY
JEFFERSON
OHIO RIVER
SITE
BEDFORD
PLEASANT
PROVIDENCE
1
2
3
4
2
N
LEGEND
SOIL ASSOCIATIONS
1 Wheeling-Weinbach-Huntington
2 Beasley-Mercer-Fairmount
3 Mercer-Crider-Nicholson
4 Lowell-Fairmount
0
2
4
SCALE OF MILES

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SOIL ASSOCIATIONS
OF TRIMBLE COUNTY

FIGURE 5.2.3-1

Wheeling soils are generally present at higher elevations toward the back edge of the flood plain area. They are deep, naturally fertile, well-drained loamy soils. In lower lying areas, they are subject to flooding.

Weinbach soils, usually present at higher flood plain elevations, are deep, somewhat poorly drained, and silty. They have a fragipan at about 18 to 20 inches. They are subject to occasional flooding when present in lower lying areas.

Huntington soils are present along river sides of the site. These soils are deep, silty, well drained, and subject to annual flooding.

The characteristics of the minor soils range from somewhat poorly drained (Newark), through moderately well drained (Sciotoville), to excessively drained (Larkin).

The Beasley-Mercer-Fairmount Association occupies about 38 percent of the county. The association is composed as follows:

Beasley soils - 29%
Mercer soils - 27%
Fairmount soils - 26%
Minor soils - 18%

Minor soils are the Lowell, Cynthiana, and Fairmount soils on the uplands and the Boonesboro along the flood plains.

Beasley soils are primarily found along narrow ridge tops and adjacent upper slopes underlain by marl at about 30 inches. These soils are deep, well drained, and clayey. Mercer soils, which are present on gently sloping ridge tops and in a few places in the flood plains, are deep, silty, and moderately well drained. They have a compact fragipan about 22 to 24 inches below the surface. Fairmount soils, which are shallow, clayey, and rocky, occur primarily on steeper slopes.

In the county, a large percent of the areas occupied by the Beasley-Mercer-Fairmount Association (see Figure 5.2.3-1) is not cultivated because of adverse soil conditions and steep slopes. Pasture is extensive along ridge tops and smoother hill sides. Many of the steeper and rougher areas are in woods.

Preliminary Transmission Line Corridor (Indiana)[a]

The soils of the preliminary transmission line corridor in Clark County, Indiana are primarily moderately deep soils formed of loessal, glacial till, and alluvial material. A map of the soil associations of the preliminary transmission line corridor is presented on Figure 5.2.3-2. Selected characteristics for the soil associations within the transmission line corridor are tabulated for each assocation on Table 5.2.3-1. Generally, the surface soil texture of the corridor varies from predominantly silt loam to stony clay loam and shale. Subsurface soil textures consist of silty clay loams to stony silt loam. The soil associations of the corridor vary widely in drainage characteristics from well to poorly drained, depending on the surface topography. Areas with steep slopes, including uplands, are more well drained, while terrace and flood plain locations are poorly drained. The soils have slow to moderate permeability. Soil wetness is a moderate problem during the early stages of the growing season in the low, flat areas.

---

[a] Information on the plant site and ravines is applicable to the Kentucky transmission line corridor.

The soil associations of the preliminary transmission line corridor have a generally low to moderate natural fertility. Additionally, the soils are moderately to strongly acid and respond well to liming for agricultural production enhancement. The soils are suited to cultivation, and, except when extremely wet or flooded, can be worked easily.

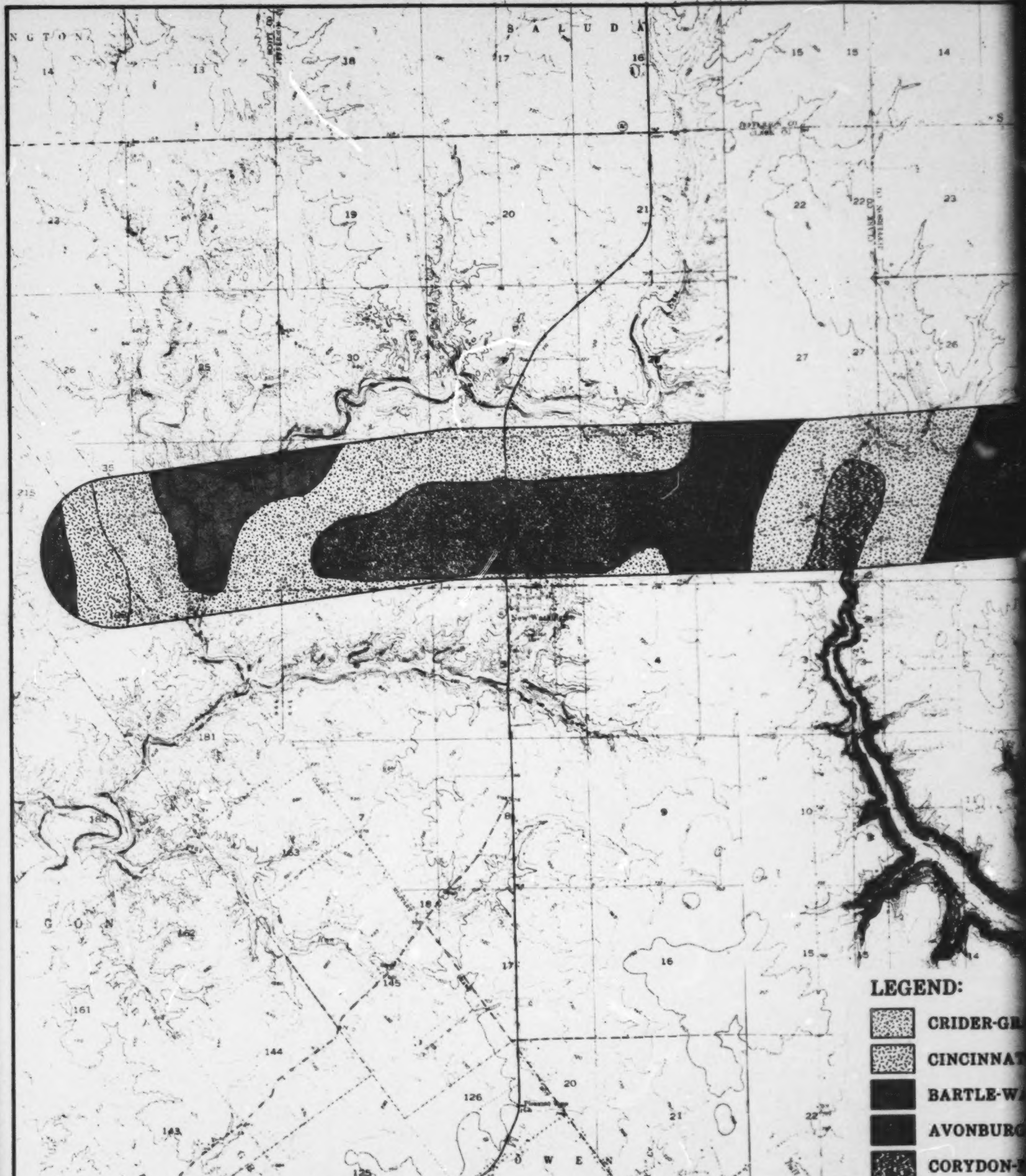
On the land designated as falling within the preliminary transmission line corridor, the topsoil erosion hazard varies from low to high. The low erosion hazard covers the soil associations of the western portion of the preliminary corridor; the middle of the preliminary corridor has a moderate erosion hazard; and the steep hills, which drop to the Ohio River on the eastern portion of the preliminary corridor, have a high erosion hazard.

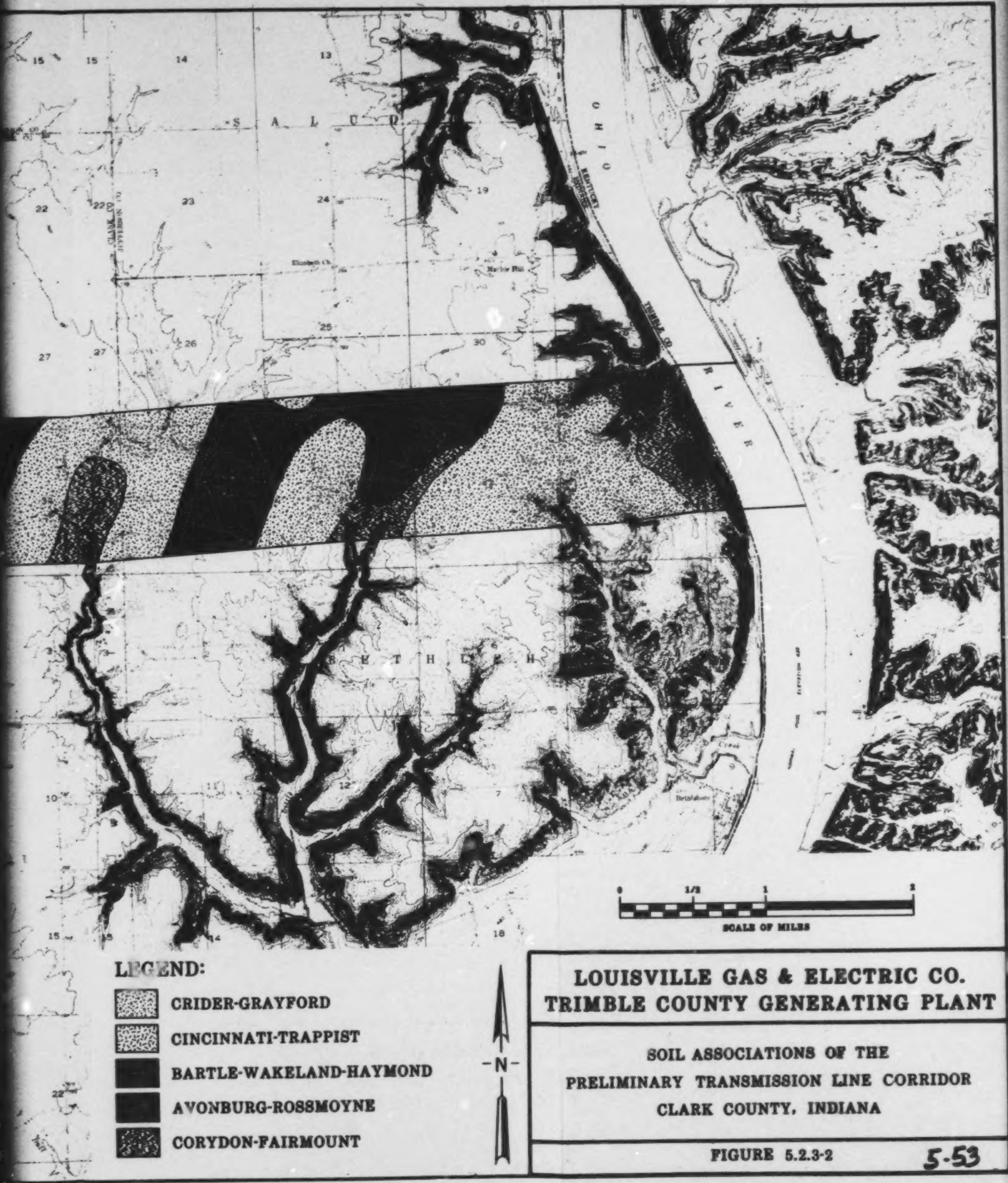
Five soil associations are found along the preliminary transmission line corridor: the Crider-Grayford, the Avonburg-Rossmoyne, the Corydon-Fairmount, the Bartle-Wakeland-Haymond, and the Cincinnati-Trappist.

The Crider-Grayford Association is found on approximately 47.3 percent of the preliminary corridor (see Figure 5.2.3-2). These are deep, well drained, nearly level to steep soils with a medium-textured to fine-textured subsoil. They are predominant on uplands and are suited to most of the crops commonly grown in the area.

The Avonburg-Rossmoyne Association is found on approximately 34.3 percent of the preliminary transmission line corridor area (see Figure 5.2.3-2). These soils are deep to moderately deep, well drained, gently sloping to strongly sloping, with a medium-textured to fine-textured subsoil. They have a low erosion hazard.

The remaining soil associations, in descending order of importance within the preliminary transmission line corridor (see Figure 5.2.3-2), include the Corydon-Fairmount Association (9.7 percent); the Bartle-Wakeland-Haymond Association (6 percent); and the Cincinnati-Trappist Association (2.7 percent). Each of these associations is somewhat distinct and a full review of the characteristics is presented in Table 5.2.3-1.


NGTON
SALUDA
LEGEND:
CRIDER-GR
CINCINNAT
BARTLE-WA
AVONBURG
CORYDON-
GON
OWEN


15
15
14
13
S A L U D
OHIO
KENTUCKY
19
22
22
23
24
Elizabeth Ch.
Marble Hill
TRIMBLE CO.
25
26
27
27
30
RIVER
BETHLEH
10
11
12
7
15
15
14
18
Bethlehem
Creek
0
1/2
1
2
SCALE OF MILES
LEGEND:
▨ CRIDER-GRAYFORD
▨ CINCINNATI-TRAPPIST
■ BARTLE-WAKELAND-HAYMOND
■ AVONBURG-ROSSMOYNE
▨ CORYDON-FAIRMOUNT
N

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SOIL ASSOCIATIONS OF THE
PRELIMINARY TRANSMISSION LINE CORRIDOR
CLARK COUNTY, INDIANA

FIGURE 5.2.3-2

TABLE 5.2 1

SELECTED SOIL CHARACTERISTICS, CLARK COUNTY TRANSMISSION CORRIDOR
TRIMBLE COUNTY GENERATING PLANT

	Soil Association				
	Crider-Grayford	Cincinnati-Trappist	Bartle-Wakeland-Haymond	Avonburg-Rossmoyne	Corydon-Fairmount
Percent of site area*	47.3	2.7	6.0	34.3	9.7
Soil order	Alfisols	Alfisols-ultisols	Alfisols-inceptisols	Alfisols	Mollisols
Depth to bedrock (inches)	4 to 8	2 1/2 to 10	4 to 10	5 to 10	5/6 to 1 2/3
Seasonal high water table (feet)	6+	6+	1 to 6	1 to 6	6+
Depth from surface (inches)	0 to 65	0 to 72	0 to 72	0 to 72	0 to 19
U.S.D.A. texture	Silt loam to silty clay loam	Silt loam to silty clay loam to shale	Silt loam to silty clay loam	Silt loam to loam	Stoney silt loam to stoney clay loam
Unified	Ml or Cl to Ch	Ml or Cl to Ch	Ml to Cl	Ml to Cl	Ml, Cl, to Ch
Permeability	Moderately slow	Slow	Slow to moderate	Slow	Moderately slow
Natural soil drainage	Well drained to poorly drained	Well drained to poorly drained	Well drained to poorly drained	Moderately well drained to poorly drained	Excessively drained
Use limitations	Erosion and runoff	Erosion and runoff	Slight to medium acidity	Strongly acid	Erosion
Shrink/swell potential	Low	Low to moderate	Low	Low to moderate	Low to high
Natural fertility	Low	Low	Low to moderate	Low	Moderate to high
Parent material	Loess and weathered limestone	Loess and glacial till over shale	Silty sediments and mixed alluvium	Loess and glacial till	Weathered limestone and calcareous clay shales
Erosion hazard	Moderate	Moderate	Slight to moderate	Low	High

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*Estimated.

Source: Nickell, 1974

5.2.4 Terrestrial Flora and Fauna

Flora of the Plant Site

The vegetation baseline study of the plant site area was conducted by consultants from the University of Louisville's Water Resources Laboratory and begun in April 1975. At this time the sludge disposal ravines had not been included in the plant design.

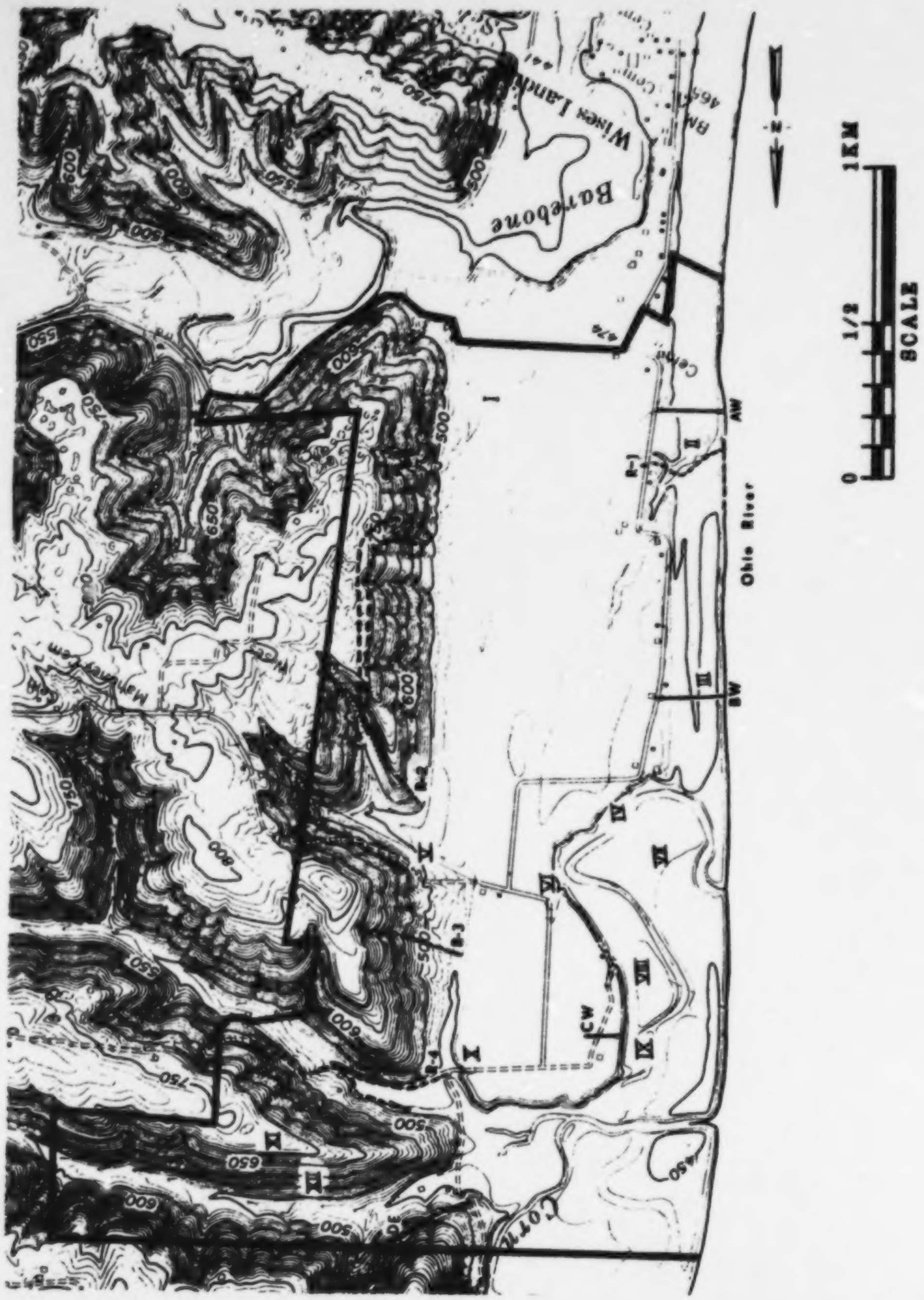
Following a site reconnaissance in April, it was proposed that four belt transects, each 2 meters wide, would be studied at intervals according to methods outlined by Vasek, et al. (1975). The transects (AW, BW, CW, DE) were to be located as follows: (1) near the southern end of the site; (2) in the area between the originally proposed location of the cooling towers and the plant proper; (3) midway between the original site of the cooling towers and the present mouth of the diverted Corn Creek; and (4) in the area of the proposed diversion of Corn Creek near the northern edge of the site (see Figure 5.2.4-1). In addition, it was proposed that 10 quadrats of appropriate size be laid out in the various habitats of the plant site.

Additional reconnaissance in late April indicated that the point-centered quarter method (Cottam and Curtis, 1956) would provide more meaningful information in the woodland areas.

In the interval between the two visits in April, a major portion of the areas laid out along the four transects had been plowed and placed under cultivation. In order to quantitatively assess the nonwoodland vegetation, an alternate plan was put into effect that included the taking of plant specimens in a number of widespread locations at regular intervals each month, and at the same time recording the relative frequencies of plants at each area, along with descriptions of the vegetational aspects of the area. Reconnaissances were made on a limited basis in other areas as well. A complete description of survey areas is provided in Appendix I.

Easily recognizable species were noted in the field, and specimens of other species were brought to the laboratory for identification according to standard guides and keys and the resources of the Davies Herbarium, University of Louisville (Gleason and Cronquist, 1963, was the ultimate taxonomic authority). In some instances, critical species were sent to specialists in particular groups for identification. An attempt was made to collect at least one specimen for each species at the site. Specimens were mounted and placed in the Davies Herbarium as a voucher collection for future reference.

The site was visited at least twice a month during April, May, June, July, August, and September 1975. The April visits included a spring wildflower survey. Other visits were made in October and November.


Barebone
Wises Landing
Ohio River
AW
BW
CW
SCALE
0
1/2
1KM
N
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
500
550
600
650
750

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VEGETATION SAMPLING LOCATIONS
PLANT SITE

FIGURE 5.2.4-1

Source: University of
Louisville, 1975a

A listing of common and scientific names of all plant species found on the entire Trimble County site is presented in Appendix J. Plants are listed according to the habitat type in which they are found.

The area around Corn Creek was visited on March 15, March 20, and April 3, 1976 for the purpose of conducting a spring wildflower survey. During the three visits the following areas were checked: pastureland, fallow land, aquatic margins, fencerows, bottomland woods, and upland woods. The plant species found in this survey, plus the April 1975 survey, are listed in Appendix K.

Floristically, the Trimble County plant site is within the Western Mesophytic Forest region (Braun, 1950) of the Deciduous Forest Formation. Küchler (1964) considers the region to be one of oak-hickory forest whose dominants are bitternut hickory, shagbark hickory, white oak, red oak, and black oak. Other components to be expected are white ash, black walnut, black cherry, and chinquapin oak.

During the survey period, the vegetation of the area was distributed approximately as follows:

Distribution of Vegetation - Plant Site

Type	Acres
Upland woods	240
Bottomland woods	84
Cultivated areas	372
Other[a]	159
TOTAL	859

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[a] Includes abandoned fields, pastureland, pond and field margins, roadsides, and homesites.

The distribution of the major vegetational areas is shown on Figure 5.2.4-2.

Tilled Cropland Vegetation

Tilled cropland (see Figure 5.2.4-2) on the site was devoted entirely to corn, although in poorly prepared areas, the corn was mixed with dense growths of Johnson grass by the middle of the growing season. Two strips of land were mowed for hay, but it is not known if they originally had been plowed and seeded.

Pastureland Vegetation

Most of the pastured areas (see Figure 5.2.4-2) on the site appear to be unimproved and have been cleared but not plowed and seeded, although some portions have been improved by plowing and seeding. A number of large trees have been left, including chinquapin oak, black oak, hickory, and black cherry. The main herbaceous plants include well browsed grasses and scattered sorrel, plantain, clover, dandelion, and other low lying weedy species. The most frequent shrub was coralberry. The large trees in the area and the composition of the shrub layer at the margins of the surrounding woods indicate that this pastureland would revert to woodland if left ungrazed for a sufficient length of time.

Abandoned or Fallow Land Vegetation

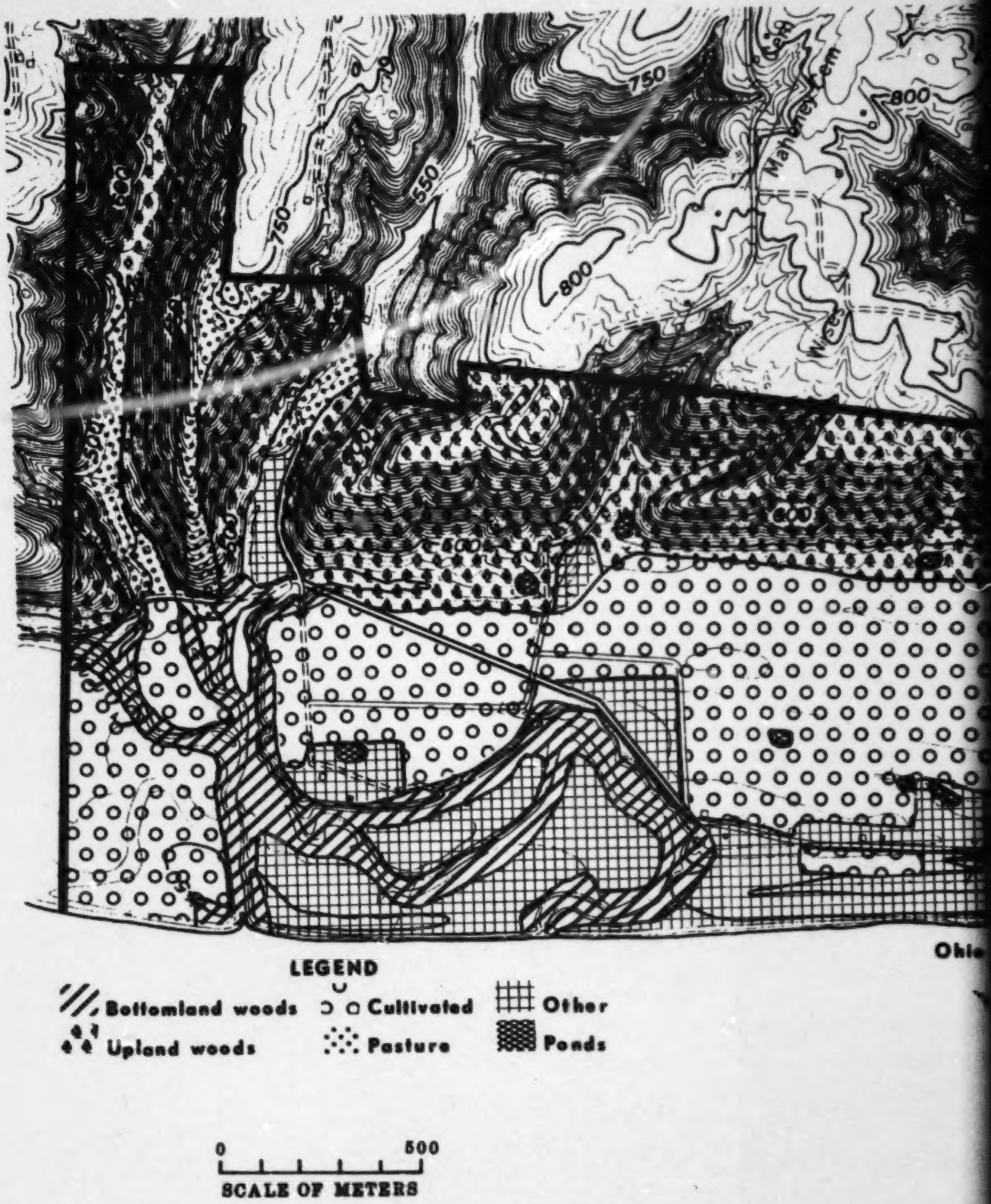
Most of the abandoned or fallow land areas (see Figure 5.2.4-2) appear to have been abandoned only recently, as there are few or no shrubs present. The dominant early season plants include fleabane, red clover, sweet clover, alfalfa, chickweed, mustard, butterweed, dandelion, plantain, henbit, buttercup, false buckwheat, dock, and violet. As the season progressed through the summer, other species became dominant, including asters, ragweed, Joe-Pye weed, goldenrod, teasel, thorny amaranth, lamb's quarters, tick-trefoil, jimson-weed, thistle, yarrow, mullein, beggar-ticks, wild carrot, Japanese clover, evening primrose, and poison hemlock. Frequently occurring grasses included bluegrass, fescue, brome grass, purpletop, foxtail, timothy, love grass, wild rye, yard grass, and oats. The two moist field areas were not visited until late August, and at that time they were covered by a dense growth of asters. Portions of those fields appeared to be well advanced into a secondary succession stage, with numerous saplings of black locust and silver maple scattered throughout.

Abandoned pastureland is occupied mostly by grasses. Plants found include bluegrass, brome grass, fescue, yard grass, wild rye, and Johnson grass. Scattered shrubs include coralberry, rose, and blackberry, along with saplings of black locust and silver maple. Scattered in the area are teasel, thistle, Joe-Pye weed, plantain, cocklebur, ragweed, milkweed, clover, and white vervain.

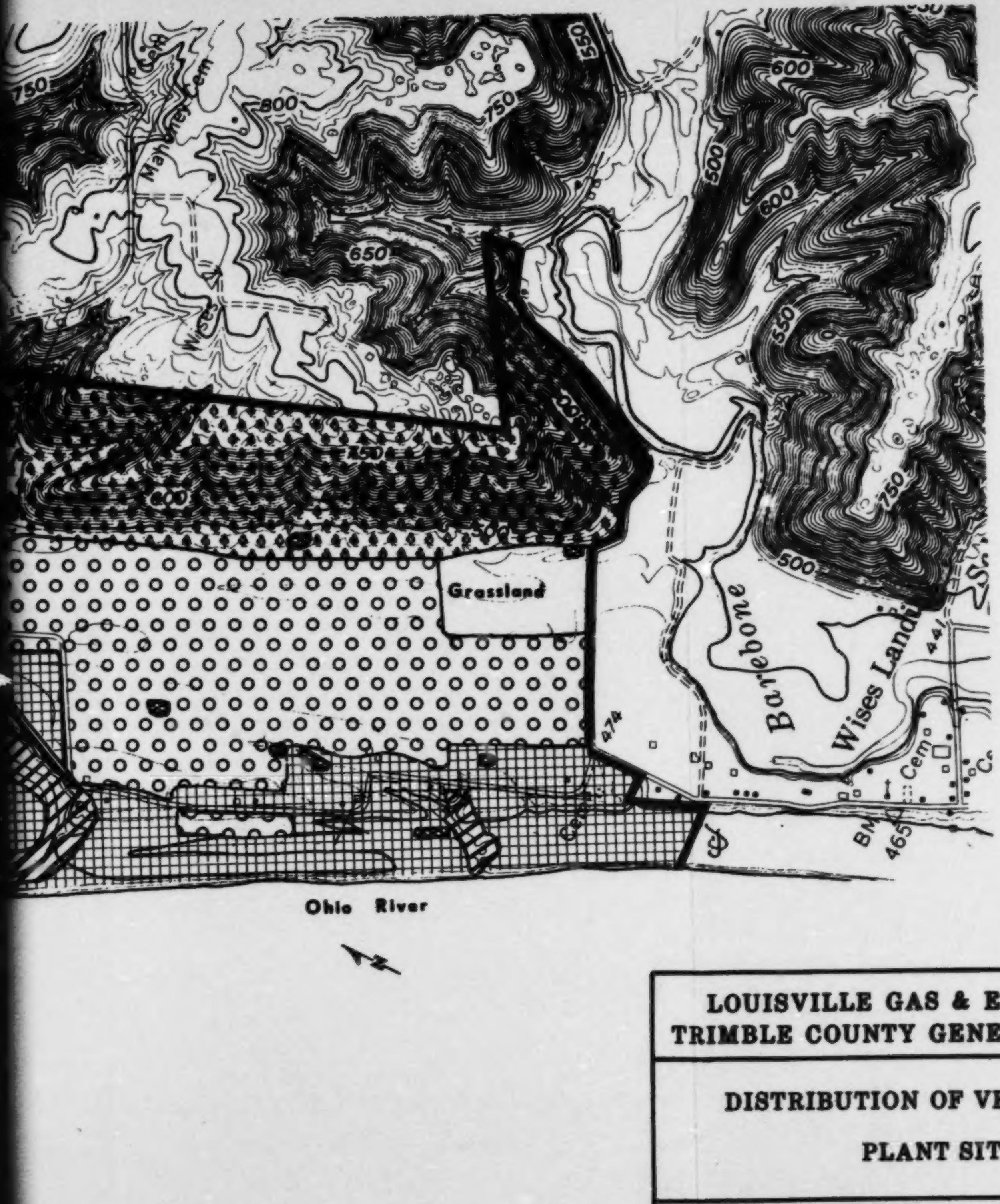
Aquatic Margin Vegetation

Areas where standing water provides aquatic margin communities are widely dispersed on the site. Ten artificial ponds were found either during reconnaissance or from aerial photographs of the site (see Figure 5.2.4-2). Some appear to be new, and no particular marsh or pond vegetation had developed within them. Others are older and contain cat-tail, duckweed, and arrowhead. Trees at the pond margins include willows, cottonwood, honey-locust, and red elm.

In addition to the ponds, standing water occurs in several wet slough areas. These areas contain dense growths of sedges and rushes and also support fog-fruit, moneywort, primrose-willow, and three species of spike rush. Some of these areas are old, abandoned pasturelands that also contain saplings of silver maple, red elm, and sycamore.


750
550
750
800
800
600
500
Ohi
LEGEND
Bottomland woods
Cultivated
Other
Upland woods
Pasture
Ponds
0
500
SCALE OF METERS

Source: University of
Louisville, 1975a


750
Mahoney Cem
800
750
550
600
500
600
650
Wises
550
750
450
600
500
Grassland
Barebone
Wises Land
441
474
Cem
BM
465
Ohio River
N

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DISTRIBUTION OF VEGETATION

PLANT SITE

FIGURE 5.2.4--2

Fencerow Communities

Fencerow communities occur along roads and between cultivated fields. The most frequent trees include red elm, sycamore, redbud, black cherry, silver maple, honey-locust, and black locust. The most frequently occurring shrubs and vines are trumpet-creeper, poison-ivy, honeysuckle, and common elder. The herbs include nodding foxtail, asparagus, timothy, hedge-parsley, and various other weedy species.

Bottomland Woods

The major portion of the bottomland woods occurs along an old oxbow of Corn Creek (Figure 5.2.4-2) that lies in the Ohio River flood plain. The bottomland woods extend up the first and second bottoms to the slopes east of the site. A small, disjunct segment of the bottomland woods area is located south of the oxbow area.

The overstory of the bottomland woods is dominated by mesophytic hardwood species. Approximately 71.5 percent of the overstory consists of four subdominant species including, respectively, hackberry (34.4 percent); yellow buckeye (15.1 percent); black walnut (11.5 percent); and American elm (10.5 percent) (Table 5.2.4-1). The remaining 14 supportive species account for 28.5 percent of the area sampled. The species making up the bottomland woods consist primarily of mesophytic species, with a few hydrophytic species including sycamore, cottonwood, ash, and silver maple.

The site supports an understory composition that consists primarily of the more vigorous and successfully competitive regenerants of the overstory. Hackberry, American elm, and papaw are the major representatives, comprising 86.8 percent of the sampled area. The remaining 13.2 percent is made up of the following species (in order of importance): yellow buckeye, blue beech, black locust, white ash, bitternut hickory, and silver maple. In addition to these understory species, greenbrier, poison-ivy, Virginia-creeper, blueberry, red cedar, papaw, and trumpet-creeper are found regularly. Ground layer vegetation includes wood-sorrel, moneywort, stinging nettle, false nettle, smartweed, and various grasses.

Successionally, the bottomland woods is an immature mixed hardwood stand, limited by seasonal flooding and soil make-up to a hydric-mesic dis-climax development. This limiting factor will prevent development of the bottomland woods to any but a mature flood plain forest type of vegetation. In the more moist portions of the oxbow area, the dominant overstory will continue to be silver maple and cottonwood; however, in the drier locations, cottonwood will probably be replaced through a gradual phase-out by American elm.

TABLE 5.2.4-1

COMPOSITION OF SLOPES OF THE BOTTOMLAND WOODS,
SOUTHERN PORTION OF OXBOW (CANOPY)[a]
TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number of Trees	Trees per Acre	Basal Area (ft^2/acre)	Relative Density
Hackberry	75	93.8	18.8	34.4
Black walnut	25	31.2	13.4	11.5
Black locust	21	26.2	10.8	9.6
Yellow buckeye	33	41.2	10.3	15.1
American elm	23	28.8	7.8	10.5
Sycamore	6	7.5	5.2	2.7
Cottonwood	1	1.2	3.8	0.5
Chinquapin oak	3	3.8	2.0	1.4
White ash	3	3.8	1.4	1.4
Big shellbark hickory	2	2.5	1.3	0.9
Silver maple	7	8.8	1.2	3.2
Bitternut hickory	2	2.5	0.7	0.9
Basswood	3	3.8	0.6	1.4
Papaw	9	11.2	0.4	4.1
Blue beech	2	2.5	0.3	0.9
Catalpa	1	1.2	0.3	0.5
Honey-locust	1	1.2	0.3	0.5
Red mulberry	1	1.2	0.1	0.5
		272.4	78.7	100.0

---

[a] Based on an inventory of a single plot 0.8 of an acre in area.

Source: University of Louisville, 1975a

Streamside Vegetation

The dominant vegetation along Corn Creek where it passes near the oxbow is similar to that of the bottomland woods. The two other streams that drain into Corn Creek from the east, however, support a different streamside vegetation. Along those streams, the dominant tree is the sycamore. By observing the lines and clusters of sycamore in the landscape, one may identify the low and stream areas of the upper bench below the slopes. Other trees of such areas include cottonwood, boxelder, blue ash, beech, and silver maple. The ground layer plants include clearweed, bouncing Bet, false rocket, spotted touch-me-not, pale touch-me-not, water-purslane, fringed loosestrife, moneywort, stonecrop, scouring rush, and smartweed.

Upland Woods

The largest habitat type on the site is the upland woods. It has been cut over several times in its history, and very few really large trees remain. The area has a diversity of slope aspects that includes east-, southeast-, northeast-, and southwest-facing slopes. This diversity has combined with variations in slope steepness and local soil conditions to produce a mosaic of different stand physiognomies. The best-developed forest occurs on the moderately steep, east-facing or northeast-facing slopes, where the canopy is closed and a well-developed leaf litter is present. One such area (R-2, Figure 5.2.4-1) was sampled quantitatively. Maple and oak were the most important trees (Table 5.2.4-2). The shrub layer includes sugar maple, dogwood, spice bush, hickory, chinquapin oak, basswood, boxelder, poison-ivy, and red cedar. In the ground layer, waterleaf, mayapple, rue anemone, wild ginger, ebony spleenwort, Spanish-needles, wild hyacinth, Virginia grape fern, bottle-brush grass, spring-beauty, and mist-flower are present.

On steep northwest- to southwest-facing slopes, conditions are more xeric (dry), and chinquapin oak, red cedar, and hickories become more important (Table 5.2.4-3). The canopy is more open, and locally well-developed shrub areas include coralberry, rose, poison-ivy, blackberry, honeysuckle, and greenbrier. In these areas, weedy species such as teasel, Joe-Pye weed, dandelion, ragweed, and vervain occur. Shagbark hickory, honey-locust, hackberry, and red cedar occur on the dry ridges.

Along the steep west- to southwest-facing slopes, the soil is interrupted by limestone outcroppings, and several sinkhole areas were observed at the top of the slopes.

The mesic (moist) maple-basswood-ash-oak woods on the site apparently are relatively stable in that they are not undergoing rapid successional change. However, local situations where chinquapin oak now dominates will probably be invaded by species with greater shade tolerance,

TABLE 5.2.4-2

IMPORTANCE VALUES FOR TREES OF THE CANOPY AND SUB-CANOPY OF THE UPLAND WOODS HABITAT TYPE, TRANSECT DE (EAST-FACING SLOPE)[a,b]
TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number of Trees	Trees per Acre	Basal Area (ft^2/acre)	Relative Density	Relative Frequency	Relative Dominance	Importance Value
Sugar maple	17	124.9	51.2	35.7	25.5	32.5	93.7
Chinquapin oak	7	53.6	12.9	15.3	17.8	8.2	41.3
Black walnut	2	14.3	30.7	4.1	5.2	19.5	28.8
White oak	2	14.3	24.3	4.1	5.2	15.4	24.7
Basswood	4	28.6	10.3	8.2	10.1	6.5	24.8
Red elm	3	21.4	13.0	6.1	7.7	8.3	22.1
White ash	3	21.4	2.4	6.1	5.2	1.5	12.8
Black oak	3	21.4	2.4	6.1	5.2	1.5	12.8
Hackberry	2	14.3	2.2	4.1	5.2	1.4	10.7
Dogwood	2	14.3	0.4	4.1	5.2	0.3	9.6
Hop-hornbeam	1	7.1	2.6	2.0	2.5	1.6	6.1
Ohio buckeye	1	7.1	0.6	2.0	2.5	0.4	4.9
Hickory	1	7.1	4.5	2.0	2.5	2.9	7.4
TOTAL	48	349.8	157.5	99.9	99.8	100.0	299.7

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[a] See Appendix 5.2.4-A.

[b] Data was compiled by the University of Louisville, 1975a. Based on 12 points.

TABLE 2.4-3

IMPORTANCE VALUES FOR TREES OF THE UPLAND WOODS HABITAT TYPE, TRANSECT DE (NORTHWEST- TO SOUTHWEST-FACING SLOPES)[a,b]
TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number Of Trees	Trees per Acre	Basal Area (ft^2/acre)	Relative Density	Relative Frequency	Relative Dominance	Importance Value
Chinquapin oak	5	55.3	19.4	13.8	13.9	9.5	37.2
Red cedar	6	63.2	1.6	15.9	13.9	0.8	30.6
Boxelder	2	23.6	12.0	5.9	6.9	5.9	18.7
Sugar maple	3	31.6	24.5	7.9	3.4	12.0	23.3
Hickory	2	23.6	13.9	5.9	6.9	6.8	19.6
Black walnut	3	31.6	16.3	7.9	6.9	8.0	22.8
Sycamore	1	11.8	26.9	3.0	3.4	13.1	19.5
Black cherry	1	11.8	24.3	3.0	3.4	11.9	18.3
Black locust	1	11.8	22.9	3.0	3.4	11.2	17.6
American elm	2	23.6	6.9	5.9	6.9	3.4	16.2
Redbud	3	31.6	0.5	7.9	6.9	0.2	15.0
Honey-locust	1	11.8	9.0	3.0	3.4	4.4	10.8
Dogwood	1	11.8	0.5	3.0	3.4	0.2	6.6
Black oak	2	23.6	19.5	5.9	6.9	9.5	22.3
Hackberry	3	31.6	6.3	7.9	10.3	3.1	21.3
TOTAL	36	398.3	204.5	99.9	99.9	100.0	299.8

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[a] See Appendix 5.2.4-A.

[b] Data compiled by the University of Louisville, 1975a. Based on 9 points.

which will gradually replace the chinquapin. On the steep, xeric, west- to southwest-facing slopes, a solid canopy rarely forms, and there is direct penetration of light from the sides. In these areas, the mixed oak-hickory-cedar combination probably will persist.

No species on the federal list of endangered and threatened species of plants (U.S. Government Printing Office, 1975) was found on the plant site. Of scientific note, however, is a possible range extension of the primrose-willow along the Ohio River. This species is normally distributed in the coastal plains from Florida to Texas, north to Georgia, Missouri, and Illinois. It has been reported that primrose-willow is cultivated in some areas, including New York. The population on the site appears to be stable, and individual plants showed a good seed set. A specimen has been sent to Dr. Peter Raven at the Missouri Botanical Garden for verification.

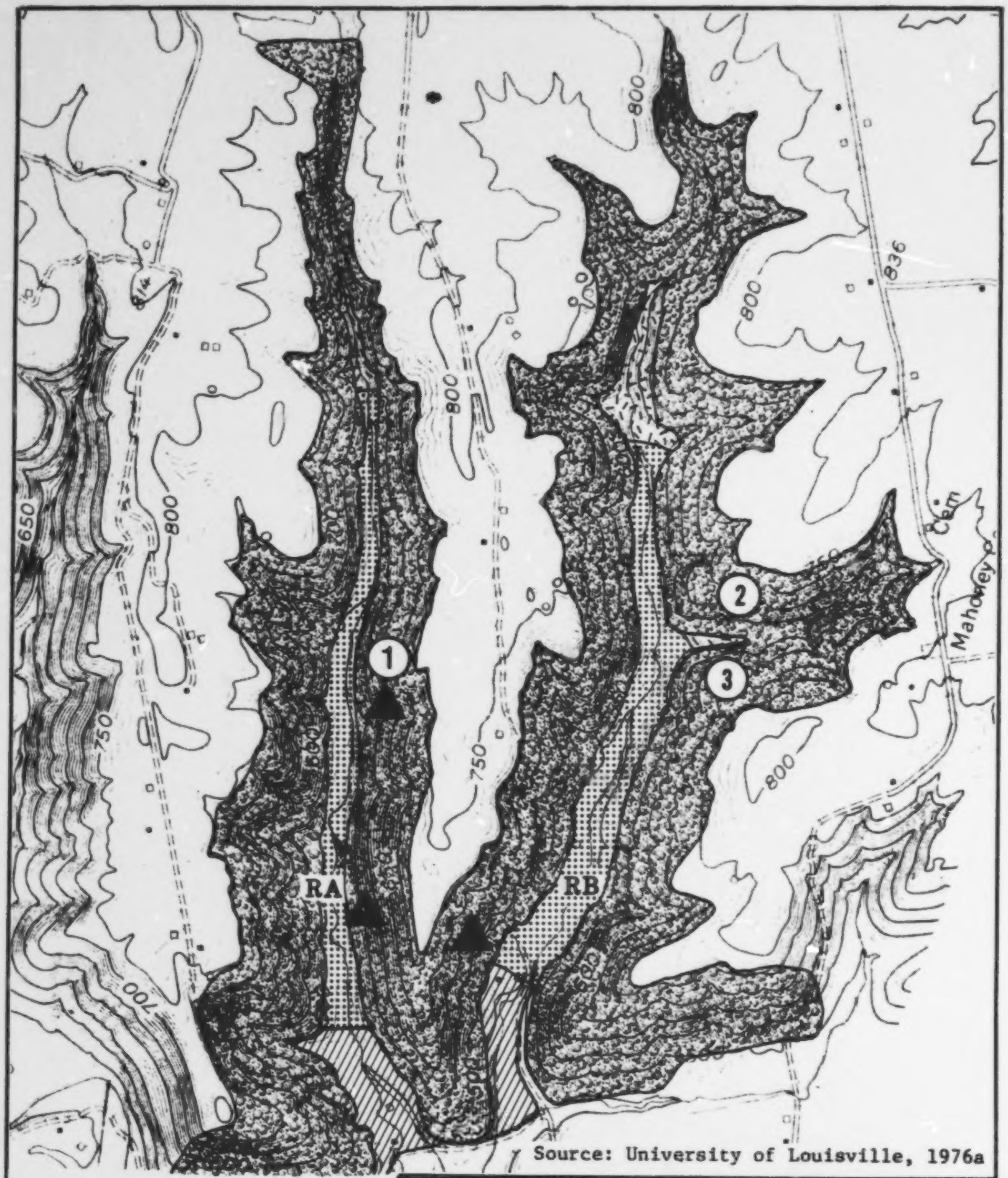
Flora of the Ravines

A study of the vegetation of two ravines of the Trimble County Generating Plant site was conducted on April 27, May 4, and May 11, 1976. The area of the upland woods portion of the ravines was estimated to be about 1,175 acres. Other vegetation was distributed as follows: pastureland--163 acres; fallow or other--68 acres; riparian--34 acres.

The point-centered quarter method of Cottam and Curtis (1956) was used to sample the tree vegetation of the north-facing slopes in Ravine RA and of the east-facing and west-facing slopes in Ravine RB. In each case, the sampling began at the top of the slope, and 15 points were selected at approximately 30-pace intervals as a path was followed at a diagonal across the slope from top to bottom. At each point, the overstory (trees with full or partial sun exposure) was recorded, and plants of the groundcover layer were noted. At some points, the understory trees (those with no sun exposure) of a height greater than 10 feet were also sampled, using the point-centered quarter method. Visual estimates of the abundance of herbaceous groundcover species were also made at each point.

The floors of both ravines, throughout their length, were surveyed by a reconnaissance, and the various species of plants were noted. In addition, the riparian vegetation of Ravine RB was analyzed in more detail; trees occurring in the stream bed or on the adjacent bank were counted at several points. A list of all plant species and their place of occurrence is presented in Appendix L, and a vegetative cover map of the area is provided on Figure 5.2.4-3.

The most important overstory trees on the north-facing slope (Ravine RA) are sugar maple, white ash, and elm (Table 5.2.4-4); the dominant trees are sugar maple and ash. Table 5.2.4-5 lists the number of trees


800
800
836
800
800
Cem
Mahoney
2
3
1
650
800
750
750
800
RA
RB
700

Source: University of Louisville, 1976a

LEGEND:

▨ UPLAND WOODS
▨ RIPARIAN HABITAT
▨ PASTURELAND
▨ FALLOW OR OTHER
① VEGETATION SAMPLING LOCATION
▲ MAMMAL SAMPLING STATION

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

DISTRIBUTION OF VEGETATION, RAVINES RA AND RB

FIGURE 5.2.4-3

TABLE 5.2.4-4

IMPORTANCE VALUES FOR TREES OF THE OVERSTORY LAYER OF THE NORTH-FACING (350°) SLOPE, RAVINE RA[a] TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number of Trees	Trees/Acre	Basal Area (ft^2/Acre)	Relative Density	Relative Frequency	Relative Dominance	Importance Value
Sugar maple	22	103.9	53.2	36.7	24.4	29.4	90.5
White ash	8	37.8	46.4	13.4	14.6	25.6	53.6
Red elm	9	42.5	16.5	15.0	19.5	9.1	43.6
Black oak	5	23.6	20.1	8.3	12.3	11.1	31.7
Hackberry	4	18.9	10.6	6.7	7.3	5.9	19.9
Black walnut	2	9.4	21.4	3.3	2.4	11.8	17.5
Boxelder	4	18.9	4.2	6.7	7.3	2.4	16.4
Redbud	2	9.4	2.2	3.3	4.9	1.2	9.4
Chinquapin oak	2	9.4	1.7	3.3	4.9	0.9	9.1
Black cherry	2	9.4	4.7	3.3	2.4	2.6	8.3
Total	60	283.2	181.0	100.0	100.0	100.0	300.0

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

TABLE 5.2.4-5

SIZE CLASS AND NUMBER OF TREES ON THE NORTH-FACING (350°) SLOPE, RAVINE RA[a]
TRIMBLE COUNTY GENERATING PLANT SITE

Species	Size Class in Inches (DBH) 3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	≥21	Tota
Hackberry		1	1		1		1				4
Black oak	1		1	1			1		1		5
Red elm	1	3	3	1							8
White ash		1	4				1		1	2	9
Redbud		1	1								2
Sugar maple	5	5	3	1	3	3	2	1			23
Boxelder	1	1		1							3
Chinquapin oak		2									2
Black cherry			1	1							2
Black walnut							1			1	2
Total	8	14	14	5	4	3	6	1	2	3	60

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

by species in 2-inch size classes. The most frequently occurring tree in the understory is sugar maple, and there is a well-developed leaf litter throughout the area. The shrub layer is dominated by spice bush and includes dogwood, numerous seedlings of ash, hackberry, elm, and sugar maple, along with Virginia-creeper and poison-ivy. The most frequent groundcover species are listed in Table 5.2.4-6.

The most important overstory trees of the east-facing slope of Ravine RB are chinquapin oak, black walnut, and red cedar; the dominant species is chinquapin oak (Table 5.2.4-7). Table 5.2.4-8 lists the number of trees by species in 2-inch size classes. The most frequent understory trees are Ohio buckeye and redbud. In some areas the canopy is closed, and a well-developed leaf litter is present. The most frequent shrub is spice bush. Where the canopy is open, various grasses are found, including bluegrass, fescue, and orchard grass. The most frequent woody groundcover plants are honeysuckle, poison-ivy, bramble, and coralberry.

The west-facing slope is less steep than the east-facing slope, but the drainage appears better, and more frequent outcroppings of limestone are present. The most important overstory trees of the west-facing slope of Ravine RB are chinquapin oak, red cedar, and black oak; the species with the greatest dominance is chinquapin oak (Table 5.2.4-9). Table 5.2.4-10 lists the number of trees by species in 2-inch size classes. The most frequently occurring understory trees are sugar maple and red cedar. At four points, the understory was no taller than 6 feet and consisted primarily of spice bush and seedlings of sugar maple, buckeye, oak, and elm. Under the closed canopy, the leaf litter is well-developed and supports a number of typical ephemeral spring species including toothwort, trillium, celandine-poppy, bloodroot, and twin-leaf. The most frequent groundcover plants are poison-ivy, delphinium, twin-leaf, and wild ginger.

The floor of Ravine RA is bordered on the southeast side by a stream and primarily consists of cleared but unimproved pastureland. The most frequent groundcover species are bluegrass, fescue, orchard grass, and brome grass. The undisturbed growth of the grasses suggests that cattle have not grazed it this spring (1976), although they were present during the survey in 1975. Scattered stands of bramble, coralberry, honeysuckle, and rose are also present in the open pasture.

The floor of Ravine RB is bordered by a stream that initially flows along the south side, crosses to the north side, and then crosses again to the south side and flows under the road at the entrance to the ravine. Along the stream, the most frequent trees are sycamore and black walnut. Other trees and their frequencies are given in Table 5.2.4-11. The groundcover species of Ravine RB are essentially identical to those of Ravine RA. However, because cattle still graze Ravine RB, the cover is lower and less dense.

TABLE 5.2.4-6

FREQUENCY FOR GROUND COVER SPECIES IN UPLAND WOODS, TRIMBLE COUNTY GENERATING PLANT SITE

Species	Frequency (%)
Poison-ivy	100.0
Larkspur	93.0
Wild ginger	80.0
Cleavers	80.0
Virginia-creeper	40.0
Violet	40.0
Chaerophyllum	33.3
Solomon's seal	33.3
Virginia grape fern	33.3
Bluegrass	33.3
Celandine-poppy	26.7
Toothwort	26.7
Fescue	26.7
Greenbrier	20.0
Stonecrop	20.0
Sedge	20.0
Bladder-nut	13.3
Moonseed	13.3
Coralberry	13.3
Honeysuckle	13.3
Wake-robin	13.3
Jack in the pulpit	13.3
Waterleaf	13.3
Touch-me-not	13.3
Blue phlox	13.3
Fire-pink	6.7
Avens	6.7
Dutchman's breeches	6.7
Grape	6.7
Smooth rock-cress	6.7
Total	859.6

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

TABLE 5.2.4-7

IMPORTANCE VALUES FOR TREES OF THE OVERSTORY LAYER OF THE EAST-FACING (075°) SLOPE, RAVINE RB[a] TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number of Trees	Trees/Acre	Basal Area (ft^2/Acre)	Relative Density	Relative Frequency	Relative Dominance	Importance Value
Chinquapin oak	9	42.4	37.9	15.0	14.3	31.6	60.9
Black walnut	12	56.6	20.5	20.0	16.6	17.1	53.7
Red cedar	12	56.6	19.2	20.0	14.3	16.1	50.4
Sugar maple	7	33.0	19.6	11.7	11.9	16.3	39.9
Ohio buckeye	5	23.6	7.5	8.3	7.0	6.2	21.5
Red elm	3	14.1	1.6	5.0	7.1	1.3	13.4
Sycamore	2	9.4	7.7	3.3	4.8	6.4	14.5
Black oak	2	9.4	1.9	3.3	4.8	1.6	9.7
Tulip tree	2	9.4	1.3	3.3	4.8	1.1	9.2
Boxelder	2	9.4	0.4	3.3	4.8	0.3	8.4
White ash	1	4.7	0.8	1.7	2.4	0.6	4.7
Redbud	1	4.7	0.6	1.7	2.4	0.5	4.6
Hackberry	1	4.7	0.6	1.7	2.4	0.5	4.6
Basswood	1	4.7	0.5	1.7	2.4	0.4	4.5
Total	60	282.7	120.1	100.0	100.0	100.0	300.0

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

TABLE 5.2.4-8

SIZE CLASS AND NUMBER OF TREES ON THE EAST-FACING (075°) SLOPE, RAVINE RB[a]
TRIMBLE COUNTY GENERATING PLANT SITE

Species	Size Class in Inches (DBH) 3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	≥21	Total
Red cedar	1	5	3	1	1	1					12
White ash		1									1
Chinquapin oak	1			3	3	2		1	1		11
Black walnut	2	5	1	3	1	1					13
Redbud	1	1									2
Maple	2	1		1	2			1			7
Sycamore				1	2	1					4
Tulip tree	1	1									2
Ohio buckeye	1	2	1		1						5
Red elm	2	1									3
Boxelder	2										2
Hackberry		1									1
Basswood	1										1
Black oak		1	1								2
Total	14	19	6	9	10	5	0	2	1	0	66

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

TABLE 5.2.4-9

IMPORTANCE VALUES FOR TREES OF THE OVERSTORY LAYER OF THE WEST-FACING (260°) SLOPE, RAVINE RB[a] TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number of Trees	Trees/Acre	Basal Area (ft^2/Acre)	Relative Density	Relative Frequency	Relative Dominance	Importance Value
Chinquapin oak	18	77.0	37.9	30.0	23.7	34.7	88.4
Red cedar	14	59.9	15.7	23.3	23.7	14.4	61.4
Black oak	7	29.9	19.3	11.7	13.2	17.7	42.6
Sugar maple	6	25.7	11.8	10.0	7.9	10.8	28.7
White ash	6	25.7	8.9	10.0	10.5	8.2	28.7
Black walnut	4	17.1	4.8	6.7	7.9	4.4	19.0
Ohio buckeye	2	8.6	3.0	3.2	5.3	2.8	11.3
Sycamore	1	4.3	4.2	1.7	2.6	3.9	8.2
Tulip tree	1	4.3	2.3	1.7	2.6	2.1	6.4
Redbud	1	4.3	1.1	1.7	2.6	1.0	5.3
Total	60	256.8	109.0	100.0	100.0	100.0	300.0

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

TABLE 5.2.4-10

SIZE CLASS AND NUMBER OF TREES ON THE WEST-FACING (260°) SLOPE, RAVINE RB[a] TRIMBLE COUNTY GENERATING PLANT SITE

Species	Size Class in Inches (DBH)										
	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	≥21	Tota
Chinquapin oak		4	5	4	2	1	1		1		18
Redbud			1								1
Red cedar	4	6	1	1	2						14
White ash	1	3		1	1						6
Ohio buckeye			1	1							2
Black oak			1	3	1	2					7
Sugar maple	1	1	1	2			1				6
Black walnut		1	2	1							4
Sycamore						1					1
Tulip tree			1		1						2
Total	6	15	13	13	7	4	2	0	1	0	61

---

[a] Based on 15 points.

Source: University of Louisville, 1976a

TABLE 5.2.4-11

SPECIES OF TREES FOUND AT STREAMSIDE, RAVINE RB TRIMBLE COUNTY GENERATING PLANT SITE

Species	Number of Trees	Percent of Total
Sycamore	49	39.8
Black walnut	13	10.7
Boxelder	11	8.9
American elm	8	6.5
Hackberry	6	4.9
Cottonwood	5	4.2
Sugar maple	4	3.3
Redbud	3	2.4
Black cherry	3	2.4
Ohio buckeye	2	1.6
Papaw	2	1.6
Black oak	2	1.6
Osage-orange	2	1.6
Honey-locust	2	1.6
Black locust	2	1.6
Tulip tree	2	1.6
Hop-hornbeam	2	1.6
Beech	1	0.8
White ash	1	0.8
Chinquapin oak	1	0.8
Blue beech	1	0.8
Southern black haw	1	0.8
Total	123	99.9

Source: University of Louisville, 1976a

No plant species on the federal list of threatened and endangered species were found during the visits to Ravines RA and RB.

Flora of the Transmission Line Corridors

Transmission Line Right-of-Way (Kentucky)

The transmission lines from the plant site to the Trimble County tie-in (described in Section 4.2.8) will travel 3,778 feet through a 400-foot-wide corridor that crosses State Route 754 and Barebone Creek before climbing to the tie-in point. The total acreage to be occupied by the corridor is 34.5 acres. The distribution of vegetation in this proposed corridor is as follows:

Vegetation of the Trimble County Transmission Line Corridor

Type	Acreage	% of Total
Wooded land	18.4	53
Cultivated land	12.7	37
Open field/pasture	3.4	10
TOTAL	34.5	100

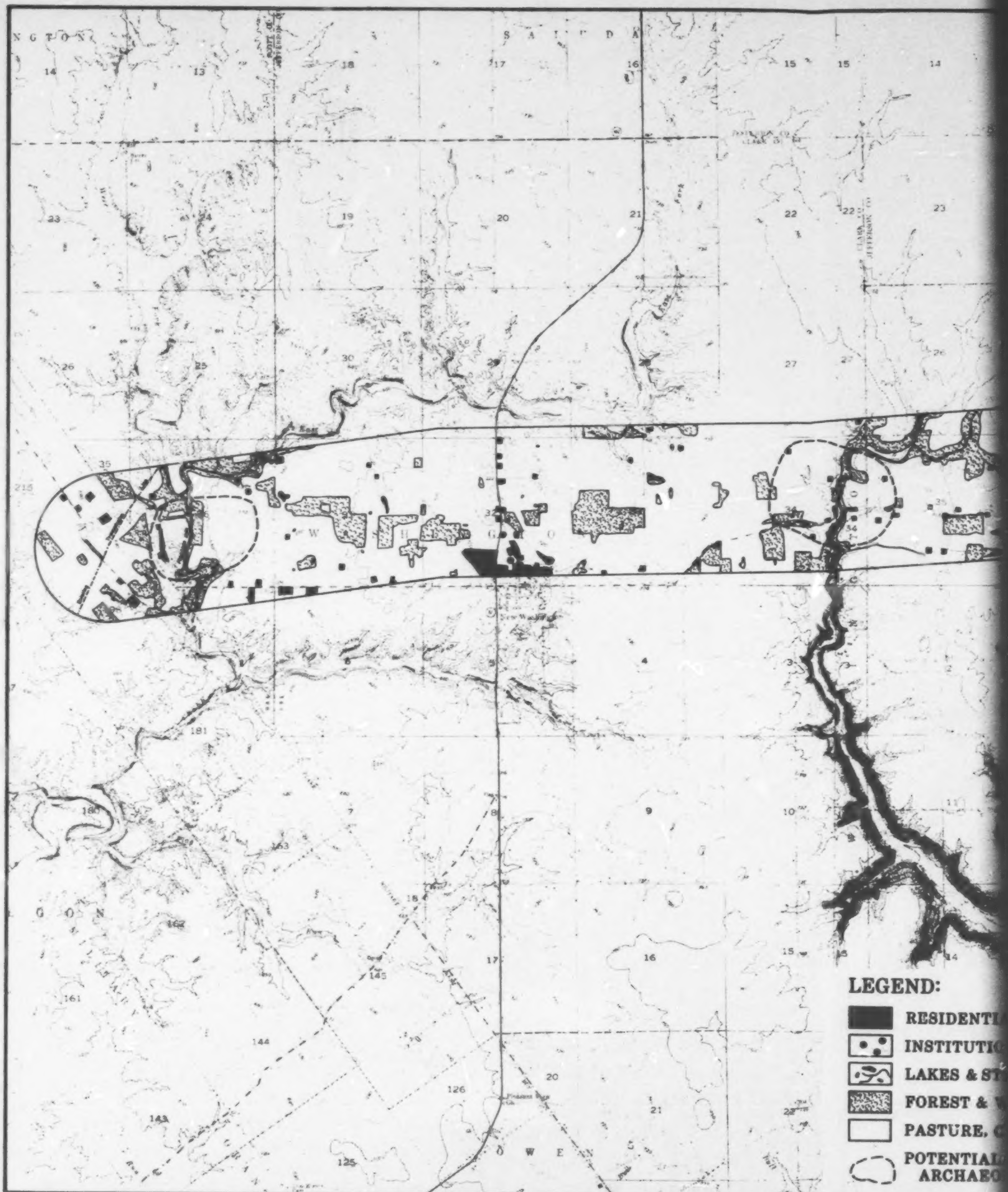
Source: Dames & Moore, 1977

No vegetative field surveys were conducted along this corridor; vegetative types and acreages were identified by visual inspection of an aerial photograph of the area. The plant species comprising the vegetation of the corridor are expected to be identical to those of the plant site and the ravines.

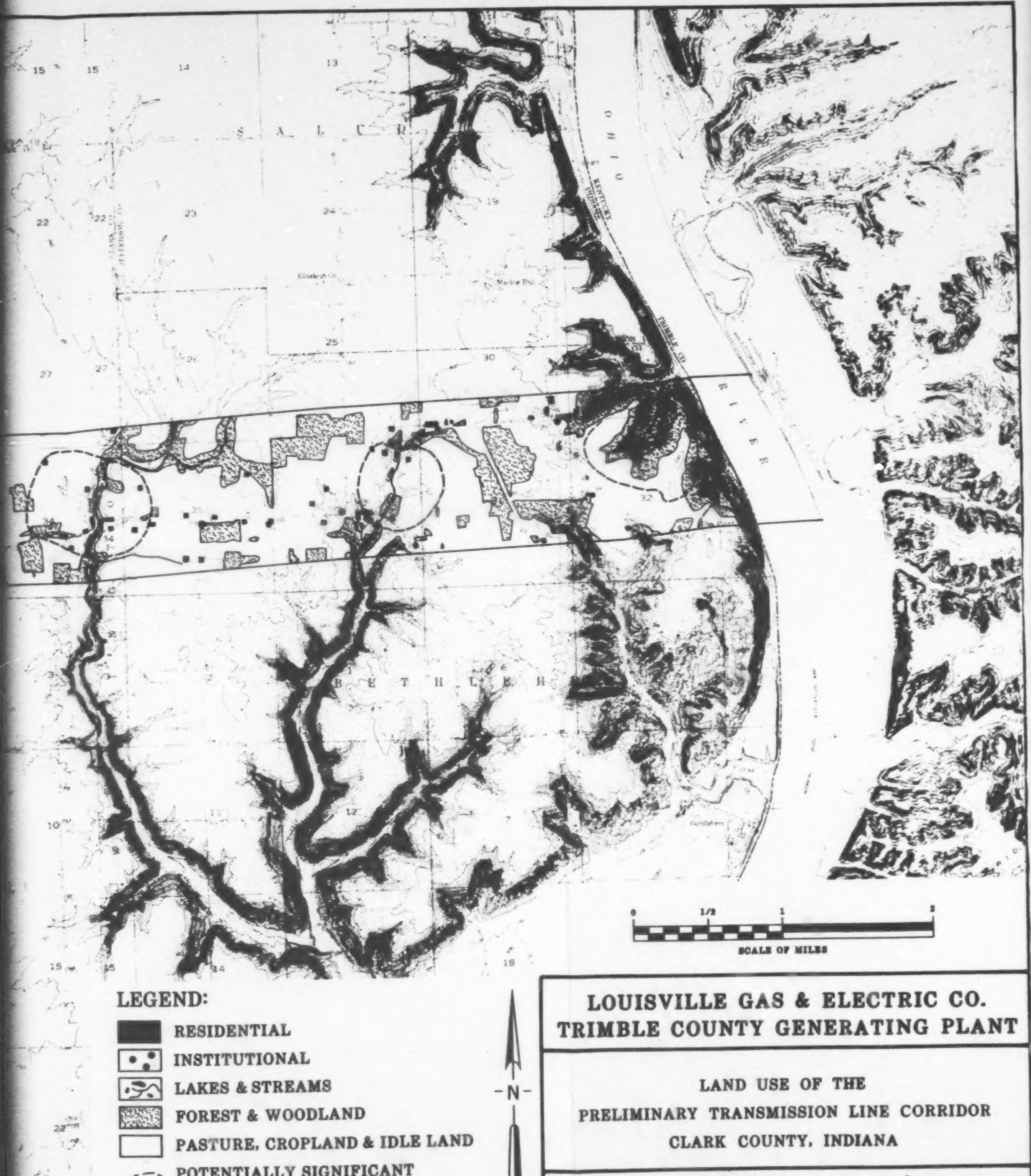
Preliminary Transmission Line Corridor (Indiana)

The following discussion of the vegetation of the mile-wide Clark County preliminary transmission line corridor is based on a review of available literature and a brief site visit.

The preliminary transmission line corridor (see Figure 5.2.4-4) extends in a westerly direction from the Trimble County site across the Ohio River into Clark County in Indiana. The vegetation of this portion of Indiana falls within the Western Mesophytic Forest region in the area of Illinoian glaciation (Braun, 1950). The preliminary corridor is within two forest types (Küchler, 1964): the Oak-Hickory Forest and the Beech-Maple Forest, in which the bitternut hickory, shagbark hickory, white oak, red oak, and black oak of the Oak-Hickory Forest are combined with the beech and sugar maple of the Beech-Maple Forest. Additional



NGTON
SALUDA
OWEN
GON
New Washington
LEGEND:
RESIDENTIA
INSTITUTIO
LAKES & ST
FOREST & W
PASTURE, C
POTENTIAL
ARCHAEO


S A L ... C R
O H I O
R I V E R
KENTUCKY
INDIANA
TRIMBLE CO
B E T H L E H
Elizabeth Ch.
Marble Hill
Bethlehem
15
15
14
13
22
22
23
24
19
25
27
27
30
32
34
35
34
12
10
7
15
15
14
18
0
1/2
1
2
SCALE OF MILES
LEGEND:
▇ RESIDENTIAL
● INSTITUTIONAL
LAKES & STREAMS
▨ FOREST & WOODLAND
☐ PASTURE, CROPLAND & IDLE LAND
POTENTIALLY SIGNIFICANT ARCHAEOLOGICAL AREAS
N

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

LAND USE OF THE
PRELIMINARY TRANSMISSION LINE CORRIDOR
CLARK COUNTY, INDIANA

FIGURE 5.2.4-4

supportive components of the preliminary transmission corridor vegetation include pin oak, river birch, sweetgum, sycamore, chinquapin oak, tulip tree, white ash, blue ash, basswood, and black walnut. In the "knobstone" area of Clark County, including the extreme western edge of the preliminary corridor, the summits of the "knobs" are generally covered with oaks, hickories, and occasional scrub pine.

The original vegetation of Clark County has been extensively modified by agricultural practices. Currently within the preliminary corridor, forestland occupies only 22 percent of the total land area, while field vegetation (pastureland, cropland, fencerows, and idle land) occupies 71 percent. Forestland is found primarily in woodlots and along streams; it includes, as subtypes, upland, riparian (flood plain), and riverbank woods. The following table compares the acreages of the two types of vegetation within the corridor with the acres they occupy within Clark County and Indiana.

Forestland and Field Vegetation:
Preliminary Transmission Corridor,
Clark County, and Indiana

	Forestland (acres)	Field (acres)
Indiana	3,761,000	16,179,000
Clark County	25,528	82,528
Preliminary Corridor	1,424	4,542

The actual right-of-way (150 feet wide) of the transmission line would traverse 76.3 acres of forestland and 252 acres of field vegetation, if it follows the centerline of the preliminary corridor. These acres constitute the following percentages of the total within the county and the state:

	% of County	% of State
Forestland	.3	.002
Field	.3	.001

Forestland vegetation along the preliminary transmission corridor is composed of several subgroup cover types. In the extreme western portion of the preliminary corridor, the major species are tulip tree, black walnut, red oak, white oak, black oak, and hickory. Along Fourteenmile Creek, west of New Washington (see Figure 5.2.4-4), the major species are cottonwood, black walnut, sugar maple, sycamore, tulip tree, and white ash. In the vicinity of New Washington, the woodlots consist of pin oak, red river birch, sugar maple, sweetgum, swamp white oak, and white ash. In several large tracts of woods east of New Washington, the major species are pin oak, sugar maple, sweetgum, sycamore, tulip tree, and white ash. Along the bluffs of the Ohio, topographic and edaphic variations have produced a varied species composition. Species of greatest occurrence in mesic (damp) locations are cottonwood, black walnut, sugar maple, sycamore, tulip tree, and white ash. In xeric (dry) locations, the following are dominant: black walnut, chinquapin oak, red oak, white oak, tulip tree, white ash, basswood, and blue ash. In addition to seedling regenerants of these major species, understory vegetation of the forestland sites is quite varied but generally includes grape, greenbrier, honeysuckle, Virginia-creeper, trumpet creeper, hackberry, papaw, spice bush, rose, blackberry, elderberry, cherry, locust, and elm.

The upland areas of the preliminary corridor will probably remain stable, with oak species predominating over the hickory species. In riparian and riverbank areas, significant water level fluctuations could affect the species composition. Low water conditions will favor the xeric-mesic species, while high water will favor the mesic-hydric (wet) species.

A significant influence on the successional patterns of all of the forestlands is the commonly practiced selective clearing of timber and veneer species, as well as the practice of clearcutting to expand available pasture and cropland areas.

Field vegetation (pasture, cropland, and associated fencerows) predominates within the preliminary transmission corridor. Agricultural development within the study area is based on the farming of corn, soybeans, wheat, oats, clover-grass hay, and alfalfa-grass hay. Croplands are devoted to the production of these crops, while pasturelands are used for livestock production, primarily hogs and cattle. Most of the pastures consist of a mixture of Ladino clover, red clover, and grass, with recent introductions of fescue pastures. Fencerow vegetation includes most of the cultivated species, in addition to red oak, hackberry, red elm, sycamore, honey-locust, and black locust. Shrubs common to the fencerows are trumpet creeper, honeysuckle, and blackberry. Herb species include foxtail, wild asparagus, dill, timothy, teasel, thistle, milkweed, bittersweet, and barnyard and orchard grass.

These areas are not likely to develop beyond their current use pattern because the agricultural productivity of the area is moderate to high. The practices of mowing, spraying, fertilizing, burning, and clearing serve to change the vegetation pattern seasonally as well as yearly. If portions of these areas within the preliminary corridor were abandoned, they would revert to oldfield vegetation. In turn, the oldfield vegetation would pass progressively through annual, then perennial shrubby and woody stages until a wooded site had developed. This site would resemble the surrounding area in terms of diversity and species composition.

No species on the federal list of endangered and threatened species of plants was found during the brief field visit. Hemlock, a relict association in the area, grows in a few scattered localities in the "knobs" region and was observed within the preliminary corridor. This species is found in greater abundance in Fountain and Montgomery Counties.

Fauna of the Plant Site and Ravines

Birds

A literature study was conducted by consultants from the University of Louisville to search out any references pertinent to either the Trimble County plant site or to the area in general. A species list of migratory and summer resident birds was compiled from incidental sightings from March through June 1975. In addition, the University of Louisville consultants conducted three separate bird observations. Two all-day periods were conducted in May, and a 1-day, intensive breeding bird road survey was conducted in June to delineate the various species of birds breeding within each of the three representative habitat types (oldfields and lowland and upland woods) on the plant site. The survey was conducted according to guidelines established by Mengel (1965) and conforms to the standards by the U.S. Fish and Wildlife Service, Bird Population Station, Patuxent, Maryland. Figure 5.2.4-5 shows the location of the route. A complete description of the route and of each of the 50 stops was kept. In this analysis, comparisons are made with other counts in Kentucky (data from 29 to 39 counts annually for the years 1966 through 1974) and with the single count nearest Bedford (Goshen count, Oldham County, taken on June 22, 1975).

Perhaps the best and most thorough work on the birds of Kentucky is that of Mengel (1965). Mengel noted that the ornithological knowledge of the Blue Grass Region (of which Trimble County is a part) was fairly extensive, particularly because of the region's proximity to Louisville and Jefferson County, where much of the ornithological research in Kentucky was conducted. Mengel and Monroe worked for a number of years in Oldham County, which adjoins Trimble County on the south, and Mengel himself spent much time studying the birds of the region.

According to the U.S. Army (1975a), 240 species of birds have been reported as migrants or residents in various parts of Kentucky. This list is at some variance with Mengel (1965), who lists 296 species as having been reliably recorded within Kentucky's boundaries from the earliest times up to 1960. In another account by Barbour, et al. (1973), 275 bird species are reported as regular breeding or visiting species. Whatever the actual number of bird species in Kentucky, about 50 percent (127 species) have been sighted on the Trimble County plant site during the present study (Appendix M).

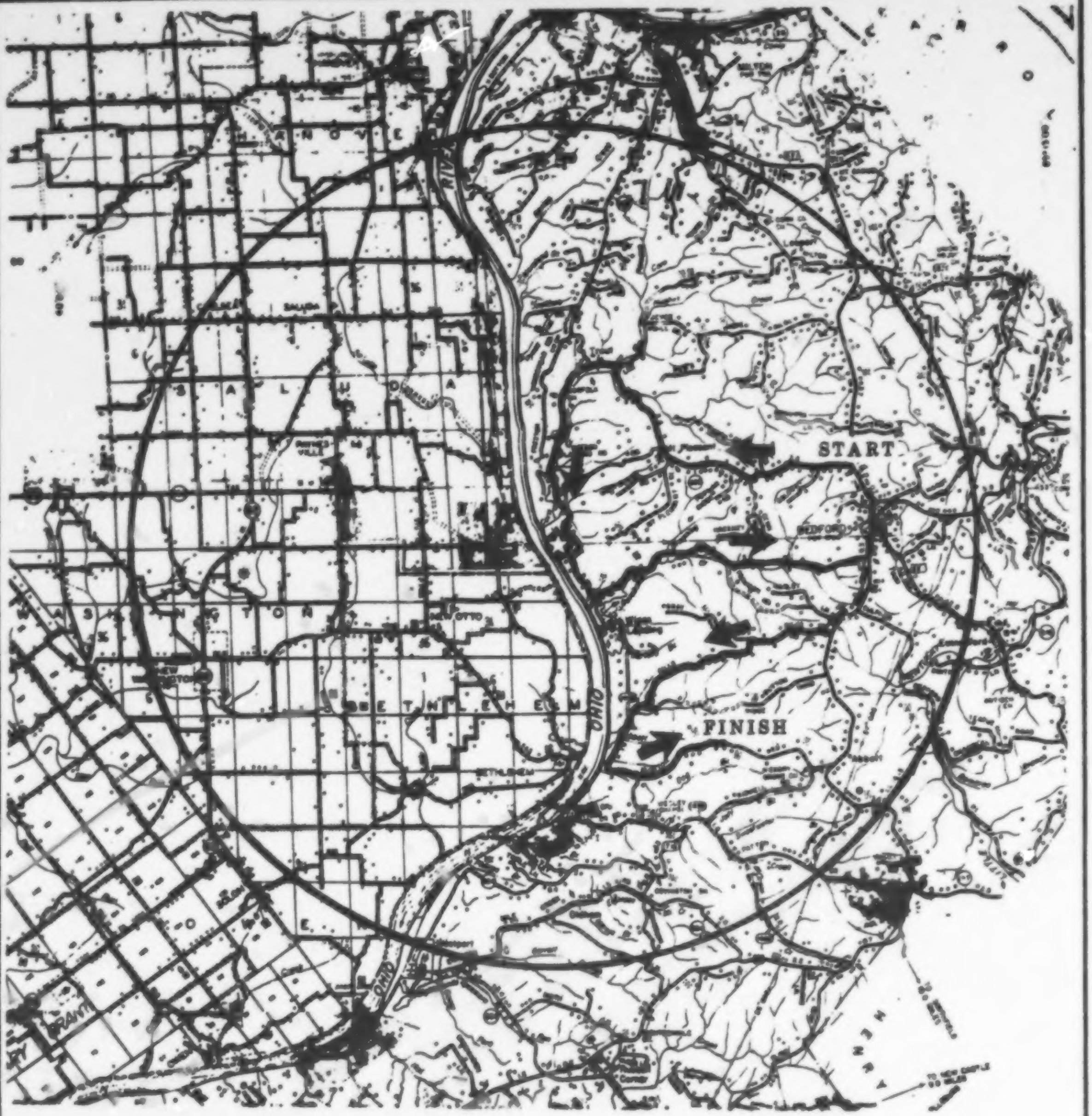
The summer breeding bird count (herein called the Bedford summer count) conducted by the University of Louisville consultants was taken on June 21, 1975. Figure 5.2.4-5 shows the location of the route. Compared with the Goshen count (which is virtually the norm for typical Kentucky counts), the Bedford count contained more stops in forested habitat (mostly on the slopes of the escarpment), many more in second growth or "oldfield" habitat (especially in the riverine flood plain), and fewer in agricultural land in current use; as a result, species densities in the first two habitat types tended to show higher values, while those in the agricultural lands were usually lower. Appendix N lists comparisons between the Bedford and Goshen counts for the more common and significant species and relates these to the 1974 mean for counts throughout Kentucky.

Forest species generally were twice as abundant on the Bedford count as on the Goshen count, and they were often three or more times more common than in the 1974 Kentucky mean. Forest species include the yellow-billed cuckoo, common flicker, red-bellied woodpecker, blue jay, Carolina chickadee, tufted titmouse, Carolina wren, wood thrush, yellow-throated vireo, red-eyed vireo, and brown-headed cowbird. Two forest species, the wood pewee and rufous-sided towhee, ran just about the mean and slightly over the mean, respectively, constituting exceptions to the generalization just made (reasons unknown, perhaps sampling error).

Species inhabiting primarily second growth areas were likewise generally higher in the Bedford count than in either the Goshen count or in the Kentucky mean for 1974. These included eastern kingbird, eastern bluebird, warbling vireo, prairie warbler, yellow-breasted chat, orchard oriole, cardinal, indigo bunting, American goldfinch, and field sparrow. Of considerable note is the abundance of indigo buntings--the 120 recorded being the highest number on any Kentucky count; in addition, the species was recorded at all 50 stops, which apparently has never occurred before for any species on any Kentucky count.

The Bedford route values approximated or were lower than the Kentucky mean. Even though there were similar amounts of open habitat (agricultural land and homesites) along both routes, the Bedford route values were often only a fraction of those for the Goshen count. (The Goshen count often leads the state in high numbers of blackbirds and other species associated with agricultural development.) Species in this category identified in the survey were the bobwhite, mourning dove, chimney swift, barn swallow, eastern meadowlark, red-winged blackbird, common grackle, and song sparrow. The chipping sparrow is the only major exception to this trend, being much more abundant on the Bedford count than on the Goshen count.

Some species known to be nesting in the area were not recorded during the survey; these include the pileated woodpecker, hairy woodpecker, Bewick's wren, ovenbird, Baltimore oriole, dickcissel, and savannah sparrow.


START
FINISH
OHIO
RIVER
BETHLEHEM
WASHINGTON
SALUDA
BEDFORD
-N-

Source: University of Louisville, 1975a

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AVIAN SURVEY ROUTE

FIGURE 5.2.4-5

In summary, the 1-day breeding bird count indicated that areas of forest and second growth on the escarpment and flood plain are relatively rich in characteristic species, both in diversity and in population densities, with the few exceptions noted.

The oxbow area on the plant site appears to be an important area for waterfowl during both nesting and migratory periods. This conclusion is based on various literature sources; Dames & Moore's contacts with the Trimble County Conservation Officer, Ronald Sherman, and with residents of Wises Landing; and incidental observations recorded by the University of Louisville consultants.

Bellrose (1976) indicates that several species of ducks have major (greater than 500,000 birds) migratory corridors that encompass the plant site boundaries: widgeon, green-winged teal, blue-winged teal, black ducks, pintails, ring-necked ducks, and bufflehead. Although no major goose migratory corridors encompass the site area, three corridors go through Kentucky. Records indicate that nocturnally migrating waterfowl cover a broad front (Bellrose, 1976); thus, it is not uncommon to observe some Canada and/or lesser snow geese throughout Kentucky during the migration periods.

The major nesting species of duck likely to be found at the plant site is the wood duck. Kentucky's breeding population of wood ducks is around 12,000 birds (Sutherland, 1971), which is considered to be a medium breeding population (Bellrose, 1976).

Local residents report that the oxbow area is heavily used by ducks during the fall and spring migratory periods and that geese have also been seen there. Sherman indicated that the oxbow area has been a stop-over area for waterfowl, including geese, for many years, and that the nearby agricultural fields provide an important food source.

Sherman also noted that the largest concentrations of birds usually appear during December and January and during the spring. Flooded conditions are common during the spring migratory period. At this time, the flooded fields provide both resting areas and a major source of food for waterfowl preparing to return to their breeding grounds.

Eight species of ducks and one of geese were incidentally observed by the consultants from the University of Louisville at the Trimble County Generating Plant site during 1975 (Appendix M). No bird surveys were conducted during the fall. During March 1975, much of the plant site was flooded. The University of Louisville consultants on the site on one weekend indicated that there were several hundred ducks within sight at any time using the oxbow and Corn Creek area. They believe that there were well over a thousand such birds in the area. The principal species identified were mallards, black ducks, pintails, lesser scaup, blue-winged teal, and wood ducks. Gadwalls and American widgeon were also believed to be present.

The oxbow area (including Corn Creek) also provides good wood duck nesting habitat; the sycamores and silver maples found in this area are two of the most important trees used for their nesting (Bellrose, 1976). The permanent water provided by Corn Creek and the oxbow is a source of a diversity of insects, the main food of young wood ducks. Acorns, seeds from many plants, and corn found in the area provide food for the adult birds.

No rare and/or endangered bird species were observed by investigators during the breeding bird survey or in incidental sightings at the Trimble County Generating Plant site. However, three bird species whose range includes the site are listed as rare or endangered in Kentucky. They are the golden eagle, the northern bald eagle, and the osprey (Barbour, et al., 1973). The golden eagle is an occasional winter resident in western Kentucky, but this species may occur at any place or in any season (Barbour, et al., 1973). The northern bald eagle is a rare to fairly common winter resident of Kentucky and is most abundant from mid-October to late April. Most frequented habitats include large rivers and impoundments (Barbour, et al., 1973). Osprey are most likely to be encountered during the spring and fall seasons. This species is an uncommon to fairly common transient that frequents large bodies of open water (Barbour, et al., 1973).

Mammals

A comprehensive literature survey was conducted by consultants from the University of Louisville to collect literature pertinent to the mammals of the general physiographic region and of the Trimble County plant site in particular.

Small mammals were sampled by consultants from the University of Louisville twice during the year in each of the three basic vegetational types found on the site (oldfields, lowland woods, and upland woods). Methods of population estimation followed Grodzinsky, Pucek, and Rysozkowski (1966), Stickle (1946), and Zippin (1958); grids of 100 snap traps baited with peanut butter and oatmeal were used. Data were gathered over a total of 1,400 trap-nights[a] for a 3.21-acre area during each trapping period. Locations of the small mammal trapping grids are shown on Figure 5.2.4-6. Representatives of each species captured were prepared as voucher specimens and were placed in the mammal collection of the Department of Biology at the University of Louisville.

In addition, consultants from the University of Louisville conducted a survey to determine the extent of use of the ravines as refugia (protected areas) by small mammals in winter. Sampling techniques were the

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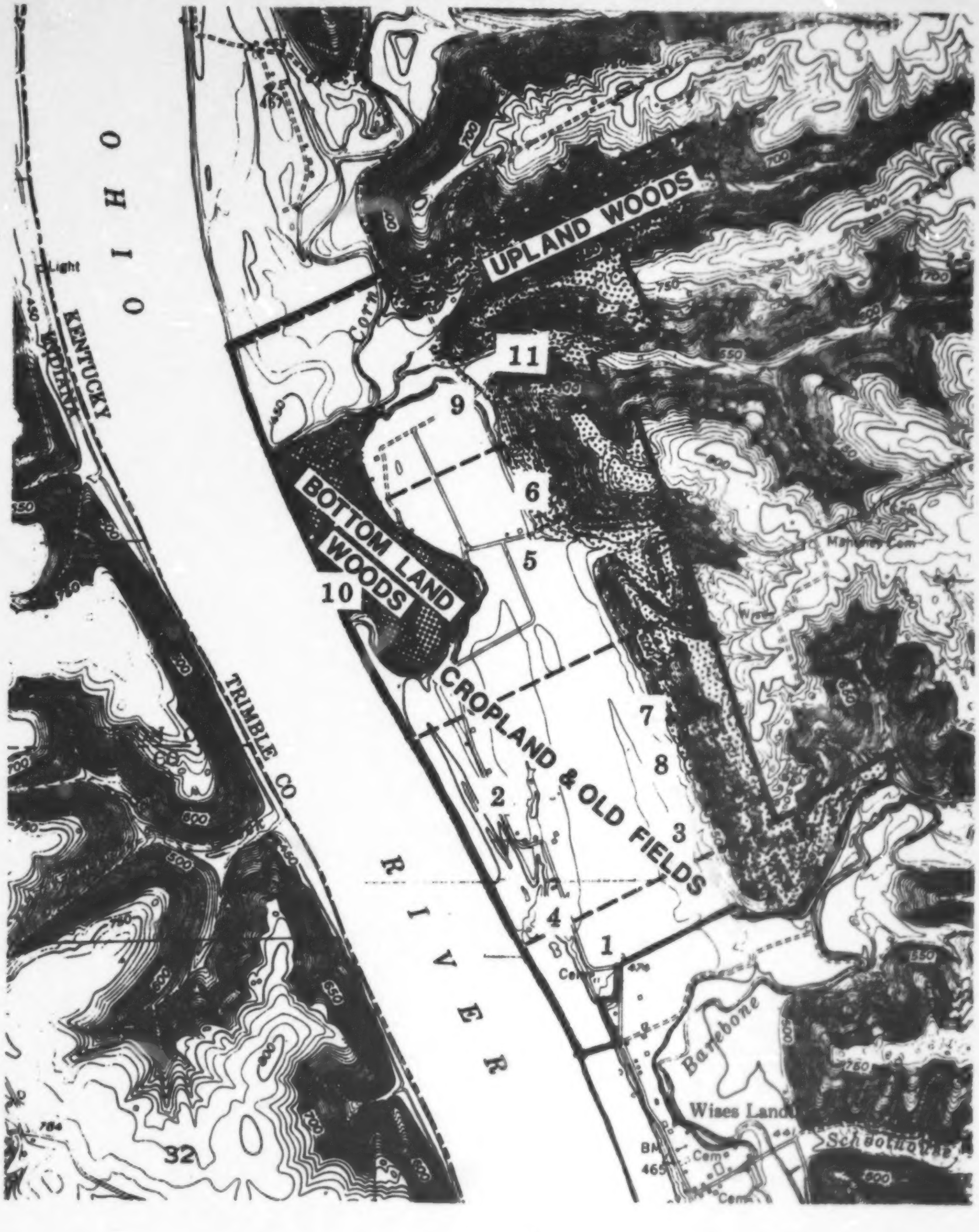
[a] A trap night is one trap set for one night.


UPLAND WOODS
11
9
6
5
BOTTOM LAND WOODS
10
CROPLAND & OLD FIELDS
7
8
2
3
4
1
OHIO
RIVER
KENTUCKY
INDIANA
TRIMBLE CO
Light
Corn
Barebone
Wises Landing
BM 465
Cem
32
0
2000
4000
SCALE IN FEET
N

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TERRESTRIAL SAMPLING TRANSECTS AND HABITATS

FIGURE 5.2.4-6

Source: University of Louisville, 1975a and b same as those used in the general survey for small mammals. Baited snap-traps were set in a grid system for three 2-day sampling periods, for a total of 600 trap-nights. Sampling was conducted during a 20-day period that ended on November 18, 1975. One site was on a warm, south-facing slope at an elevation of approximately 550 feet; the other two sampling locations were on a cooler, north-facing slope at the same elevation (Figure 5.2.4-3). A total area of 60,000 square feet was sampled.

Larger mammals were inventoried by daytime sightings, night spotlighting, and by a survey of tracks, scats, and dens at the plant site during November 20-21, 1976 by Dames & Moore personnel. Each major habitat type was searched for mammals and for their signs, and a night spotlighting survey route was established (Figure 5.2.4-7).

A comprehensive search of the extant literature revealed little about the general area and nothing specific to the Trimble County plant site. Barbour and Davis (1974) in their Mammals of Kentucky made no reference to the mammals of Trimble County. Robinson (1973) trapped four species of small mammals in parts of the Little Kentucky River drainage. Apparently, his is the only mammal work that had been done previously in Trimble County.

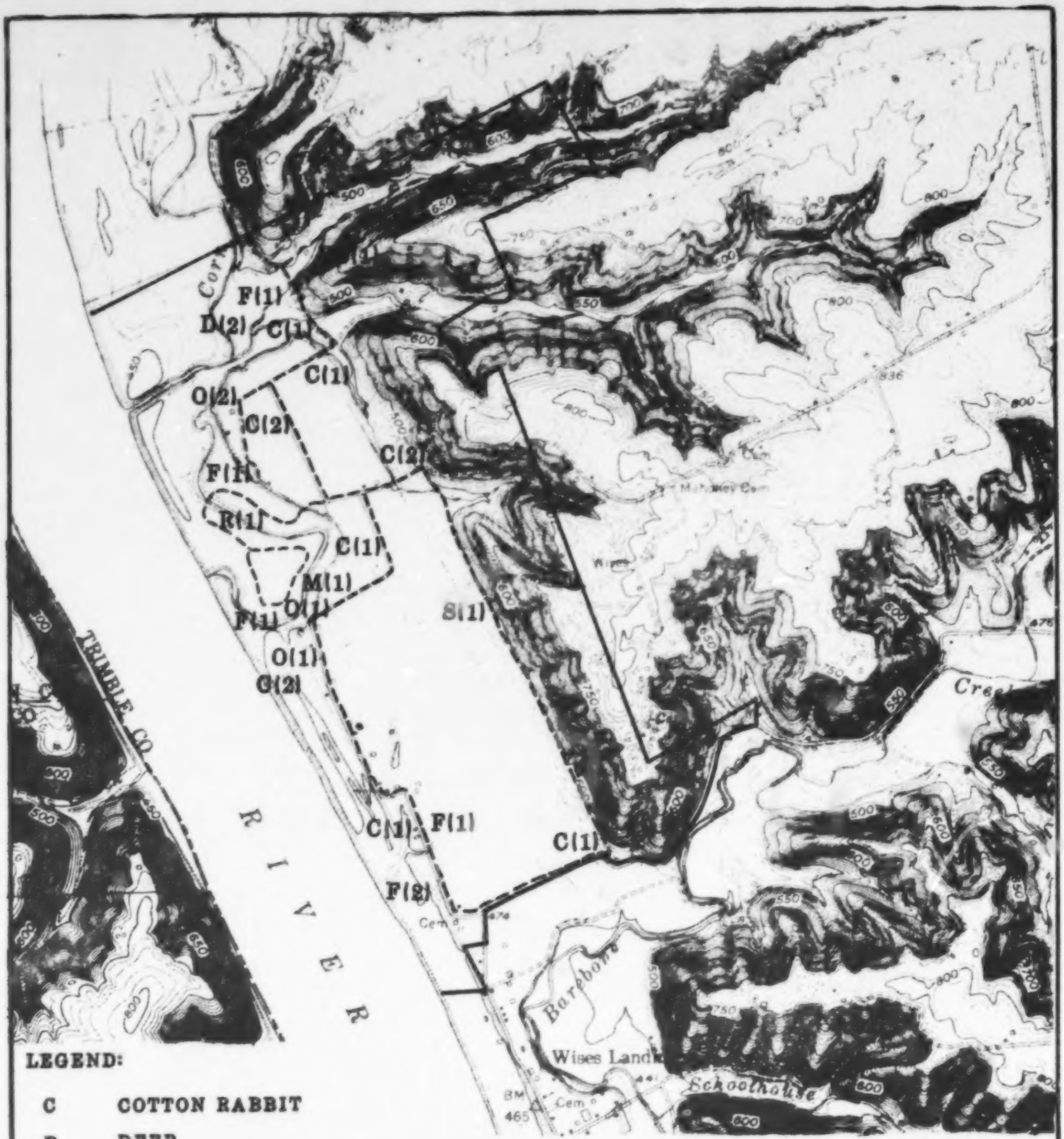
The U.S. Army (1975a) has listed 46 species of mammals for Kentucky. The ranges of 37 of these species overlap the site areas (Table 5.2.4-12). However, only 20 species have been identified (through observation or sign) on the site (Table 5.2.4-12).

During the course of the plant site trapping program, five species of small mammals were collected: the white-footed mouse, meadow vole, house mouse, short-tailed shrew, and least shrew. A total of 19 specimens were taken in oldfield habitats, 12 in lowland woods, and 9 in upland woods. The following table gives the estimated small mammal population density for each habitat type sampled.

	Habitat Type		
Sampling Period	Oldfields	Lowland Woods	Upland Woods
Spring	7.3	4.5	4.5
Fall	30.8	23.9	8.9

Further insight into the importance of each habitat type to the small mammal population is gained through estimating the reproductive success in each habitat type via the following formula:

$$\frac{\text{Fall population density - Spring population density}}{\text{Spring population density}} = \text{average number of young per breeding adult}$$


F(1)
D(2)
C(1)
C(1)
O(2)
C(2)
C(2)
F(1)
R(1)
C(1)
M(1)
F(1)
O(1)
O(1)
S(1)
C(2)
C(1)
F(1)
C(1)
F(2)
TRIMBLE CO.
RIVER
Creek
Barebone
Wises Landing
Schoolhouse
Cem
BM 465
500
550
600
650
700
750
800
836
0
2000
4000
SCALE IN FEET

LEGEND:

C	COTTON RABBIT
D	DEER
F	FOX
O	OPOSSUM
FS	FOX SQUIRREL
R	RACCOON
M	MUSKRAT
S	STRIPED SKUNK
- - -	NIGHT-TIME SURVEY ROUTE
(2)	INDICATES TOTAL NUMBER OBSERVED DURING NIGHT SPOTTING SURVEY

N

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NIGHT-TIME SURVEY ROUTE
AND RESULTS OF 2 - DAY
MAMMAL SURVEY,
NOVEMBER 1976

FIGURE 5.2.4-7

TABLE 5.2.4-12

MAMMALS THAT MAY OCCUR ON THE TRIMBLE COUNTY GENERATING PLANT SITE[a]

Common Name	Scientific Name	Expected Relative Abundance[b]
*Virginia opossum	Didelphis virginianus	abundant
*Short-tailed shrew	Blarina brevicauda	abundant
*Least shrew	Cryptotis parva	common
*Eastern mole	Scalopus aquaticus	abundant
Little brown bat	Myotis lucifugus	common
Gray bat[c]	Myotis grisescens	unknown
Indiana bat[c]	Myotis sodalis	unknown
Silver-haired bat	Lasionycteris noctivagans	rare
Eastern pipistrelle	Pipistrellus subflavus	abundant
Big brown bat	Eptesicus fuscus	abundant
Red bat	Lasiurus borealis	abundant
Hoary bat	Lasiurus cinereus	rare
Evening bat	Nycticeius humeralis	uncommon
*Eastern cottontail	Sylvilagus floridanus	abundant
*Chipmunk	Tamias striatus	common
*Woodchuck	Marmota monax	common
*Gray squirrel	Sciurus carolinensis	abundant
*Fox squirrel	Sciurus niger	common
Southern flying squirrel	Glaucomys volans	common
*Beaver	Castor canadensis	common
Eastern harvest mouse	Reithrodontomys humulis	uncommon
Deer mouse	Peromyscus maniculatus	common
*White-footed mouse	Peromyscus leucopus	abundant
*Meadow vole	Microtus pennsylvanicus	abundant
*Prairie vole	Microtus ochrogaster	abundant
Pine vole	Microtus pinetorum	common
*Muskrat	Ondatra zibethicus	abundant
Southern bog lemming	Synaptomys cooperi	common
Norway rat	Rattus norvegicus	abundant
*House mouse	Mus musculus	abundant
Meadow jumping mouse	Zapus hudsonius	common
*Red fox	Vulpes vulpes	common
*Gray fox	Urocyon cinereoargenteus	common

TABLE 5.2.4-12 (Continued)

Common Name	Scientific Name	Expected Relative Abundance[b]
*Raccoon	Procyon lotor	abundant
Long-tailed weasel	Mustela frenata	common
Mink	Mustela vison	common
*Striped skunk	Mephitis mephitis	common
Bobcat	Lynx rufus	scarce
*White-tailed deer	Odocoileus virginianus	common

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[a] Nomenclature and taxonomy follows Hall and Kelson (1959).

[b] Expected relative abundance is based on the personal experience of the University of Louisville consultant and on trapping records.

[c] Endangered species (Commonwealth of Kentucky, 1972; U.S. Government Printing Office, 1975).

*Indicates those species and/or their signs that were observed by University of Louisville consultants and/or Dames & Moore personnel.

Source: University of Louisville, 1975a; Dames & Moore, 1976.

By this formula, small mammals in oldfield habitats averaged 3.2 young/breeding adult, while those in lowland woods averaged 4.4 young/breeding adult; and there was 1.0 young/breeding adult in upland woods. The apparent fact that the lowland woods seemed best for small mammal reproduction is misleading, especially in view of the amount of inundation from the Ohio River which takes place on an annual basis. A more logical explanation is that most of the small mammals caught there in the fall migrated into the lowland woods following the receding spring flood waters. Therefore, the estimates of reproductive success are probably overstated.

The species caught during the plant site sampling program are those that one would expect to find in this kind of habitat in north-central Kentucky. Reproductive success was not particularly unusual, and the estimated small mammal densities were near normal for this region.

Heavily wooded and otherwise physically protected areas act as winter refugia for a variety of animals. It was suspected that the protected and wooded ravines might provide important winter habitat for the small mammals of the plant site. If such were the case, then use of the ravines for scrubber sludge storage could significantly affect the future of small mammals in the area. However, the ravine survey program did not uncover evidence that the ravines are being used as refugia by small mammals.

Only one individual--a short-tailed shrew--was captured in the 600-trap-night effort. Normally, the presence of shrews indicates the presence of other small mammals, as most species of shrews feed primarily on mice and rats. However, the short-tailed shrew feeds primarily on insects and earthworms and may thus be found even where other small mammals are absent.

Ten species of medium- to large-sized mammals were observed during a 2-day November 1976 mammal survey conducted at the Trimble County Generating Plant site. The number of each species observed, and its distribution within the plant site boundary, are presented in Figure 5.2.4-7. Results of the night spotlighting survey are presented in Table 5.2.4-13.

According to the Trimble County Conservation Officer, Ronald Sherman (1976), many species of mammals are very common in the plant site area, including deer, rabbit, raccoon, gray and red fox, opossum, and woodchuck. Sherman has also stated that the area is very good for wildlife because of its diversity of habitat, availability of food, and mosaic arrangement of habitat types, all of which combine to provide ideal living conditions for many mammal species.

The following discussion of each species encountered during the November field survey is designed to provide some indication of the abundance and distribution of medium- to large-sized mammals on the proposed plant site.

TABLE 5.2.4-13

AVERAGE INDICES (per mile) OF MAMMALS OBSERVED DURING NIGHT-TIME SPOTLIGHTING ACTIVITIES AT THE TRIMBLE COUNTY GENERATING PLANT SITE, TRIMBLE COUNTY, KENTUCKY, 1976[a]

Species	Number Seen	$\overline{X}$/8.9 Mile	$\overline{X}$/Mile
Opossum	2	1	0.1
Cottontail rabbit	8	4	0.4
Raccoon	1	0.5	0.0[b]
Red fox	4	2	0.2
Gray fox	1	0.5	0.0[b]
Striped skunk	1	0.5	0.0[b]
White-tailed deer	2	1	0.1

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[a] The evening survey was run for two consecutive days (November 20-21) over a mean distance of 8.9 miles.

[b] Sighted, but too few to provide an $\overline{X}$/mile index.

Source: Dames & Moore, 1976

Two opossum were observed in fields adjacent to the oxbow area during night spotlighting (Table 5.2.4-13). One road-killed animal was also encountered. Tracks were common along edges of pools and in the ravines in the oxbow areas. A large number of the dens in the bottomland woods and oxbow area appear to be utilized by opossums. The bottomland woods and edges of the upland woods on the plant site provide good habitat for the opossum, as their favored habitats are forest edges and the edges of woodland streams and ponds (Barbour and Davis, 1974).

Eleven cottontail rabbits were observed during the November field survey. The cottontail occupies a wide variety of habitat types but is most common in upland thickets and brushy farmland (Barbour and Davis, 1974). Cottontails were observed in the upland woods, fields, and bottomland woods at the plant site. The abandonment of farms on the site has resulted in an increase in the amount of brushy cover; this trend will provide excellent habitat for rabbit in the future.

Local hunters encountered during the field survey indicated that rabbits were plentiful. Rabbits rank second to gray squirrel in the number of game mammals harvested in Kentucky. An average of 950,000 rabbits of all species were taken annually in Kentucky in the 1964-1965 through 1970-71 hunting seasons (Barbour and Davis, 1974).

Woodchucks were not observed during the field survey, but their tracks and dens were encountered along the ravines and banks in the bottomland woods, along the Ohio River, and on the hillsides in the upland woods. The woodland edges adjacent to the croplands and oldfields and the ravines in the bottomland woods provide good habitat for woodchuck in the site area, as the favorite habitats of this species are forest edges, fencerows, and roadsides (Barbour and Davis, 1974).

The woodchuck is a game animal in Kentucky and ranks third in the number of game animals harvested (Barbour and Davis, 1974). There is limited woodchuck hunting in the plant site area (Sherman, 1976).

Only one squirrel, a fox aquirrel, was observed during the November field survey. The individual was seen in the upland woods, where leaf nests were fairly common. Large hollow trees, often used as den sites by this species, were not common in the upland woods. The limited number of nut-bearing trees in the bottomland woods probably restricts the abundance of squirrels in that area. The hillsides and ridgetops, which are covered by a variety of oaks and hickories and by a few walnut trees, provide the best habitat on the plant site for squirrels.

Squirrels are the most important game animals in Kentucky. The Kentucky Fish and Wildlife Resources estimates that an average of 1,309,000 squirrels were taken annually in the 1964-65 through 1970-71 hunting seasons (Barbour and Davis, 1974).

One muskrat was observed in the oxbow area during the field survey. Muskrat runs, along with numerous burrows, were observed in both the oxbow and Corn Creek areas. Tracks were seen along the Ohio River leading to burrows in the river bank. Several small ponds situated on the site were also being used by muskrat. Kentucky has little of the marshy habitat favored by muskrat; consequently, ponds, streams, and backwater areas are important to the muskrat population. Thus, the oxbow area, Corn Creek, and several small ponds provide good habitat for the muskrat.

Muskrat are an important furbearer in Kentucky and figure heavily in the fur harvest each year. Although muskrat trapping currently is practiced at the plant site, harvest figures are not available.

Four red foxes were observed in the croplands and oldfields during night spotlighting at the proposed plant site (Table 5.2.4-13). Fox droppings, consisting of hair and small rodent bones, were encountered along roads and field edges. Although available den sites (old woodchuck dens) are common in the bottomland and upland forest areas, only one active burrow was found.

The red fox is a characteristic animal of the farmlands and other open areas of Kentucky (Barbour and Davis, 1974). The brush edges and wooded areas of the site provide good habitat for red fox, and an abundant food supply composed of other mammals (i.e., small rodents, rabbits, etc.), fruits, corn, and other wildlife further contributes to the area's suitability for red fox.

Two gray foxes were observed during the field survey. Droppings believed to be from gray fox were found in the upland woods 6 feet off the ground on a large tree trunk that had partially blown over.

The wooded and hilly terrain preferred by gray fox is present at the proposed plant site. Rock outcroppings, which are favorite denning areas of the gray fox, are common in the upland woods just below the ridge line. Both the upland and bottomland woods at the plant site provide good habitat for gray fox.

Both red and gray foxes are common in the plant site area (Sherman, 1976).

Only one raccoon was observed during the field survey, yet this species is probably the most abundant of the medium-sized mammals using the site area. Tracks and droppings were abundant and concentrated in the bottomland woods and scattered in the upland woods and ravine bottoms. Raccoon sign was most concentrated along the oxbow and Corn Creek areas. Many large, hollow trees (mostly sycamore) in this area provide excellent denning areas for raccoons. At the time of the survey, raccoons were feeding heavily on corn and berries. The combination of abundant den trees, the presence of the oxbow (raccoons are strongly partial to water), and the immediately adjacent food supply, all point toward an excellent area for raccoons. This inference is borne out by the great abundance of raccoon sign.

In addition to their importance as furbearers, raccoons are also considered game animals in Kentucky. Local residents indicate that "coon" hunting is popular in the site area; however, no harvest estimates are available.

One striped skunk was observed in cropland during the night spotlighting. Favored habitats of this species include farmland, brushland, woodland edge, weedy fields, rocky areas, cliffs, and small caves (Barbour and Davis, 1974), all of which are found within the proposed plant site boundaries. As farms are abandoned in the site area, the suitability of habitat for skunks will increase. Suitable den sites for this species (old woodchuck burrows or abandoned fox dens) are common in the upland and bottomland woods.

Four deer, one a six-point buck, were observed during the November field survey. Deer tracks were found in the oldfields, upland woods, ravine bottoms, bottomland woods, and croplands. Buck rubbings were found in the bottomland woods, the ravine bottoms, and upland woods. Fresh buck scrapes were found in the ravine bottoms and on the hillsides just below the ridgetop. The abundance of sign and the information supplied by local residents and the conservation officer (Sherman, 1976) indicate that deer are common at the plant site. The diversity and mosaic arrangement of habitat types at the plant site now provide the essential life requirements for deer. Although cattle grazing in the upland woods is not yet a key factor in determining deer abundance at the site, if conditions remain unchanged, then competition for food will affect deer numbers in the future.

Of the species listed in Table 5.2.4-12, only one, the bobcat, is regarded as rare or endangered in Kentucky. The bobcat was not sighted during the survey, and no bobcat signs were noted. It is doubtful that the bobcat is found on the Trimble County plant site, as the site is sufficiently close to human habitation to preclude this species' presence.

Two species of bats listed in the Federal Register as endangered have ranges that encompass the plant site area: the gray bat and the Indiana bat. No county records exist for either of these species, nor was any evidence supporting their presence found in the area during two separate investigations of the ravine areas for suitable habitat (caves).

Gray bats are cave residents throughout the year; few have been found roosting outside caves (Barbour and Davis, 1969). During the summer, they form maternity colonies, usually in large caves containing streams; in winter, they hibernate primarily in deep pit-type caves (Barbour and Davis, 1969). Their occurrence at the site is unlikely due to the absence of caves.

The Indiana bat is limited in Kentucky to the region of limestone caves, except during migration. After leaving the caves (beginning in late March), the bats head for their summer range, where they are believed to use trees for roosting and bearing young. Because Kentucky's Indiana bat population spends its summers in Ohio, Indiana, and Michigan, except for a few males (Barbour and Davis, 1974), it is unlikely that the site provides important summer habitat for this species. In addition, the site lies well outside the designated critical habitat in Kentucky for the Indiana bat (U.S. Goverment Printing Office, 1975).

Another species listed in Table 5.2.4-12, the southern bog lemming, is notable in its absence, as specimens have been taken in Oldham County, Kentucky less than 10 miles south of the plant site. The star-nosed mole, which is abundant along the Indiana side of the Ohio River, is another species notable in its absence from the plant site; however, this is probably because the Ohio River is a physical barrier to its migration.

Amphibians and Reptiles

The University of Louisville consultants conducted a literature search to detail any scientific studies that would provide information about the amphibians and reptiles of the plant site. The field program consisted of observing and/or sampling amphibians and reptiles on an opportunistic basis in conjunction with the terrestrial and aquatic studies. Special attention was directed toward species regarded as rare and/or endangered in Kentucky.

The amphibians and reptiles of Kentucky are poorly known. The only compreshensive work devoted to Kentucky's amphibians and reptiles is that by Barbour (1971), which lists 99 species for the state. Of these, 37 species have ranges and preferred habitats that overlap the plant site; only 8 of these species have actually been observed on the site (Table 5.2.4-14).

During the spring, Fowler's toads were extremely abundant in the lowland bench areas adjacent to the receding backwaters of the Ohio River. Eastern gray treefrogs were also abundant, as evidenced by their evening chorus.

In early November 1975, studies were started that were designed to investigate intensively the amphibians and reptiles of the proposed scrubber sludge disposal ravines. These studies resulted in the addition of six new species to the list of species from the plant site (Table 5.2.4-14). A seventh species, the southern leopard frog, was also newly observed in the ravines but had previously been observed on the plant site.

In April 1976, amphibians and reptiles were again sampled in both the Corn Creek and ravine areas. The species obtained were identical to those obtained in the previous survey.

TABLE 5.2.4-14

REPTILES AND AMPHIBIANS WHOSE RANGES AND HABITATS OVERLAP THE TRIMBLE COUNTY GENERATING PLANT SITE[a]

Common Name	Scientific Name
*Snapping turtle	Chelydra serpentina
Stinkpot	Sternothaerus odoratus
*Eastern box turtle	Terrapene carolina carolina
Red-eared turtle	Pseudemys scripta elegans
*Northern fence lizard[b]	Sceloporus undulatus hyacinthinus
Ground skink	Scincella laterale
Five-lined skink	Eumeces fasciatus
Midland water snake	Natrix sipedon pleuralis
*Northern water snake	Natrix sipedon sipedon
Queen snake	Regina septemvittata
*Eastern garter snake	Thamnophis sirtalis sirtalis
*Eastern hognose snake	Heterodon platyrhinos
*Northern black racer	Coluber constrictor constrictor
*Rough green snake	Opheodrys aestivus
Black rat snake	Elaphe obsoleta obsoleta
Northern copperhead	Agkistrodon contortrix mokeson
Mudpuppy	Necturus maculosus
Red-spotted newt	Notophthalmus viridescens viridescens
Spotted salamander	Ambystoma maculatum
Small-mouthed salamander	Ambystoma texanum
Marbled salamander	Ambystoma opacum
Eastern tiger salamander	Ambystoma tigrinum tigrinum
*Northern two-lined salamander[b]	Eurycea bislineata
*Long-tailed salamander	Eurycea longicauda longicauda
Northern dusky salamander	Desmognathus fuscus fuscus
Zigzag salamander	Plethodon dorsalis dorsalis
Slimy salamander[b]	Plethodon glutinosus glutinosus
American toad	Bufo americanus
*Fowler's toad	Bufo woodhousei fowleri

TABLE 5.2.4-14 (Continued)

Common Name	Scientific Name
*Northern spring peeper[b]	Hyla crucifer crucifer
*Eastern gray treefrog	Hyla versicolor versicolor
Blanchard's cricket frog	Acris crepitans blanchardi
*Southern cricket frog[b]	Acris gryllus
*Pickerel frog[b]	Rana palustris
*Southern leopard frog	Rana pipiens sphenocephala
*Green frog	Rana clamitans melanota
*Bullfrog	Rana catesbeiana

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*Species observed at Trimble County plant site.

[a] Taxonomy follows Conant, 1975.

[b] Species known only from the sludge disposal ravines.

Source: Conant, 1975; Barbour, 1971; University of Louisville, 1975a and 1976b.

None of the species listed in Table 5.2.4-14 or found in the ravines is listed by the Commonwealth of Kentucky as rare and/or endangered.

Fauna of the Transmission Line Corridors

Transmission Line Right-of-Way (Kentucky)

No survey of the wildlife of the 3,780-foot Kentucky transmission line right-of-way was conducted. The species expected to be present within the proposed 400-foot-wide right-of-way are the same as those associated with similar habitat types on the plant site and in the ravines. The habitat types found within the proposed right-of-way are the following: wooded land (18.4 acres); cultivated land (12.7 acres); and open field/pasture (3.4 acres).

Preliminary Transmission Line Corridor (Indiana)

Within the preliminary transmission line corridor in Clark County, Indiana, there are three major kinds of wildlife: openland wildlife, woodland wildlife, and wetland wildlife. These three distinct types are primarily related to the habitat requirements of the individual species. The following paragraphs describe the wildlife likely to occur within the preliminary corridor.

Openland wildlife are those species of birds, mammals, and reptiles that normally inhabit croplands and pastures. The grasses, shrubs, and herbs that characterize openland provide forage and cover requirements for these species. Specific openland wildlife that are likely to occur within the preliminary transmission corridor are rabbits, red foxes, skunks, quails, and meadowlarks.

Woodland wildlife are species of birds, mammals, and reptiles common to areas of hardwood trees and shrubs or areas combining these types of vegetation. Examples of vegetative cover important to this habitat type include grasses and legumes, wild herbaceous upland plants, hardwood woodland plants, and coniferous woodland plants. Specific wildlife found in this type of habitat are squirrels, deer, raccoons, woodpeckers, and nuthatches.

Wetland wildlife are those species of mammals, birds, reptiles, and amphibians commonly found in wet areas, including ponds, marshes, swamps, streams, and along the Ohio River. The riparian or riverbank vegetation of wetland areas provides forage and some cover requirements for these species. Wetland wildlife likely to occur within the preliminary corridor include muskrats, ducks, geese, kingfishers, and red-winged blackbirds.

Because no wildlife field studies were undertaken, it is impossible to determine exactly what species may use the preliminary corridor area or any relative abundance figures for such species. The ranges of several wildlife species holding protected status, either federally or statewide in Indiana, are known to overlap the study area; however, their actual occurrence within the preliminary corridor is not known. Determination concerning rare, endangered, or threatened status of the wildlife must wait until the actual corridor is defined.

5.3 WATER

This section presents a discussion of the surface and ground waters to be found on or near the plant site, in the scrubber sludge disposal ravines, or within the transmission line corridors. The aquatic biology of the surface waters is also discussed. The section is divided into four major topics: hydrology, water quality, water use, and aquatic biota. For clarity of discussion, the surface waters are grouped as follows: (1) Ohio River, (2) Corn and Barebone Creeks, (3) Ravines RA and RB, and (4) transmission line corridors. Ground water is categorized by (1) plant site and ravines, and (2) transmission line corridors.

5.3.1 Hydrology

Hydrologic Characteristics: Ohio River

The site for the Trimble County Generating Plant is also the middle of McAlpine Pool, a slackwater pool formed by McAlpine Dam at Louisville, Kentucky (River Mile 607.3). McAlpine Dam is one of the original 46 locks and dams built by the Corps of Engineers on the Ohio River to facilitate navigation in the Ohio Basin (U.S. Army, 1968). McAlpine Pool extends upstream to Markland Dam (River Mile 531.5).

Under the present operations plan, the Corps of Engineers maintains a normal pool elevation of 420[1] feet in the McAlpine Pool. With this pool elevation, a 9-foot-deep navigation channel throughout this reach of river can be maintained during the low-flow period. The control is maintained by adjusting the movable gates at the dam. During extreme flood periods, the gates are raised and the river is allowed to flow freely. Thus, there is no appreciable retention of water or backwater caused by the dam during floods. In total, navigation improvements in the Ohio River Basin have no important direct effects on flood control (U.S. Army, 1968).

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[1] Much of the topography and hydrography in the Ohio River System is described in terms of the Sandy Hook Datum. This datum is 0.76 feet higher than mean sea level--1929 General Adjustment. (Gallaher and Price, 1966).

Drainage Area

The drainage area of the Ohio River at the Trimble County plant site is 91,026 square miles (Public Service Indiana, 1975, page 2.5-1). The main stem of the Ohio is fed by 14 principal tributaries. In the upstream direction they are the Kentucky, Great Miami, Licking, Little Miami, Scioto, Sandy, Guyandotte, Kanawha, Hocking, Little Kanawha, Muskingum, Beaver, Monongahela and Allegheny Rivers (Public Service Indiana, 1975, pages 2.5-1 and 2.5-2).

Rivers in the Ohio River Basin vary from steep mountain streams with cascades and rapids to very sluggish, meandering channels. Slopes of major tributaries vary from more than 100 feet/mile in the headwaters to less than 0.2 feet/mile in the flat areas near the main stem. The slope of the water surface in the Ohio River over a 20-mile reach centered at River Mile 570 is approximately 0.3 feet/mile during floods.

Precipitation

The average annual precipitation over different stations in the entire Ohio River Basin varies between 35.85 inches at Urbana, Illinois and 46.74 inches at Williamsburg, Kentucky. The maximum yearly precipitation over about 30 years of record varies between 47.07 inches at Warren, Ohio and 72.35 inches at Paducah, Kentucky. The minimum yearly precipitation over the same period of record varies between 19.70 inches at Parkersburg, West Virginia and 36.0 inches at Williamsburg, Kentucky (Public Service Indiana, 1975, page 2.5-2). For that part of the Ohio Basin upstream of the Trimble County Generating Plant site, the average annual precipitation is approximately 40 inches (Geraghty, et al., 1973).

Discharges

Streamgage records have been kept on the Ohio River at Louisville, Kentucky since 1928. (Because the drainage area of the Ohio River Basin above Louisville is only 154 square miles greater than at the Trimble County plant site, the discharges at the site are assumed to be the same as at Louisville.) In the period between 1928 and 1973, the average annual discharge at Louisville was 112,300 cfs. This figure represents a run-off of 16.73 inches/year from the watershed (U.S. Department of the Interior, 1974). The ratio of the average annual runoff to annual precipitation over the basin is approximately 40 percent.

The maximum discharge in the Ohio River at Louisville was 1,110,000 cfs. This flood peak occurred on January 26 and 27, 1937. A description of the 1937 flood (the flood of record) follows:

> The flood of January-February, 1937, was the most disastrous ever in the Ohio River Basin. Excessive and almost continuous

> rainfall from January 6-25 caused maximum recorded stages in a 705-mile reach of the Ohio from below the mouth of the Kanawha at Pt. Pleasant [West Virginia], to the mouth of the Ohio at Cairo [Illinois]. This flood interrupted virtually all communications and transportation between the north and south banks for periods ranging from a week to a month. Every highway bridge approach between Marietta [Pennsylvania] and the mouth, a distance of 800 miles, was flooded and closed to traffic with the exception of the Cincinnati Suspension Bridge. There the approaches were raised by an earth and sandbag ramp. Except for the lower reaches of the Cumberland, Green and Kentucky Rivers, this was not the most severe flood on Ohio River tributaries. It produced record stages on the Cumberland for 160 miles upstream, above the present location of Cheatham Dam (U.S. Army, 1966).

The second largest flood peak on record at Louisville was 843,000 cfs. This peak occurred on March 8 and 9, 1945. Other major floods occurred on the main stem of the Ohio River at Louisville in February 1883, February 1884, January 1907, January 1913, April 1913, March 1933, March 1945, and April 1948 (U.S. Army, 1973).

The return periods for different peak flood discharges were obtained from the U.S. Army (1966) and are presented in Figure 5.3.1-1. The discharge-frequency curve has been determined by modifying the natural river discharge frequency curve for the effects of the 32 constructed dams, and 7 dams under construction, and the 11 dams in the preconstruction planning stage in 1963. According to the curve in Figure 5.3.1-1, the 100-year peak flood discharge for the Trimble County plant site is 820,000 cfs. Subsequent studies by the U.S. Army (1975a) which take into account new flood control features estimate the 100-year flow at 760,000 cfs. The more recent studies include the effects of the reservoirs currently under construction or projected for construction and completion prior to 1985.

Records of past storms and floods indicate that more than the observed critical combinations of rainfall and runoff may be reasonably anticipated in the Ohio River Basin. Studies have shown that a slight shift in storm position or in the sequence of meteorological events would have resulted in greater flood discharges than those actually experienced. Accordingly, the Corps of Engineers has developed hypothetical combinations of storms of record to determine what other magnitudes of floods could be expected. From these studies a "Standard Project Flood" has been designated to aid in the assessment and design of river works along the Ohio River. The Standard Project Flood is defined as "A hypothetical flood representing the critical volume and peak discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions reasonably characteristic of the geographical region excluding extraordinarily rare combinations" (U.S. Army, 1967).

The Standard Project Flood for the Trimble County site is 1,575,000 cfs (U.S. Army, 1966). In computing the flood peaks, the Corps of Engineers has taken into account the regulation obtained from the 50 upstream reservoirs constructed, under construction, or in the advanced preconstruction planning phase as of July 1963.

The minimum discharge in the Ohio River at Louisville was 2,100 cfs, which occurred August 12, 1930 (U.S. Department of the Interior, 1974). Since that time, minimum annual low flows have increased because of the regulation obtained from the upstream reservoirs. Under natural conditions (no reservoirs) the 30-day, 10-year low flow at Louisville was 7,415 cfs, whereas with the 1963 Corps reservoirs, this value was increased to 12,450 cfs (U.S. Army, 1966). The most recent estimate of the 30-day, 10-year low flow at Louisville is 13,750 cfs (U.S. Army, 1973). This value was obtained by assuming completion of reservoirs currently (1975) under construction or projected for construction and completion prior to 1985. The corresponding 7-day, 10-year low flow at Louisville is 14,200 cfs. Other low flows are presented in Table 5.3.1-1.

Stages

The maximum high water level for the reach of the Ohio River adjacent to the Trimble County site occurred during the 1937 flood. At River Mile 572, this level was 470.0 feet.

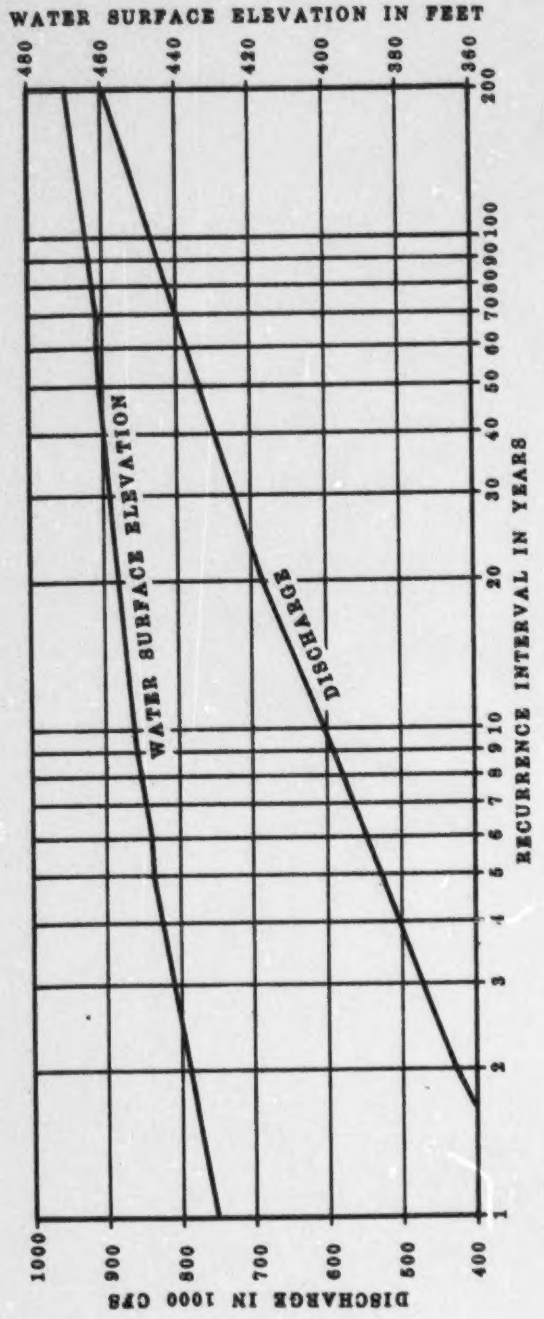
The flood stage frequency relation for river levels at the site is given in Figure 5.3.1-1. The relation was determined by the Corps of Engineers (1966) by using the modified discharge frequency curve (also shown in Figure 5.3.1-1) and the stage versus discharge curve for the river section. The river stage corresponding to the 100-year flood peak is 461 feet, and the stage corresponding to the Standard Project Flood is 482 feet. These stages are shown on the river cross section on Figure 5.3.1-2. The areal extent of flooding at the site is shown on Figure 5.3.1-3.

During periods of low flow, the level of the river at the site is largely determined by the regulation at the McAlpine Dam downstream (River Mile 607.3) and by the amount of water being passed through Markland Dam upstream (River Mile 531.5). As previously noted, the water level in the McAlpine Pool is held at elevation 420 feet during periods of low flow to provide a 9-foot-deep navigation channel throughout the pool.

Channel Geometry

As shown in Figure 5.3.1-3, the Ohio River channel is approximately 2,200 feet wide in the vicinity of the Trimble County site. At bankfull stage (elevation 445 feet), the depth of water at the deepest point in the channel is approximately 55 feet. At normal pool, the deepest part is approximately 30 feet deep.

At River Mile 570, the flood plain on the Kentucky side extends for a distance of 2,200 feet from the river bank to the base of the



LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

DISCHARGE AND STAGE FREQUENCIES
FOR THE OHIO RIVER
AT THE PLANT SITE

FIGURE 5.3.1-1

TABLE 5.3.1-1

SEVEN-DAY AVERAGE OHIO RIVER LOW FLOWS AT THE TRIMBLE COUNTY GENERATING PLANT SITE

Recurrence Interval (Years)	Low Flow (cfs)
2	18,300
5	15,500
10	14,200
20	13,100
50	12,000
100	11,200
200	10,700

Source: Public Service Indiana, 1975, page 2.5-16 bluffs. Immediately downstream, the flood plain on the Kentucky side narrows to a width of approximately 600 feet between River Miles 571.3 and 572.3. The width of the bottom of the Ohio River Valley in the vicinity of the site is approximately 1 mile.

Hydrologic Characteristics: Corn and Barebone Creeks

The western half of Trimble County is drained by a series of small streams which flow west and southwest to the Ohio River (see Figure 5.3.1-4). From south to north these are: Pattons Creek, which forms part of the boundary between Oldham and Trimble Counties; Middle Creek; Barebone Creek, which flows near the southern edge of the plant site; Corn Creek, which has several principal tributaries and drains about one-fourth of the county and is located at the northern edge of the site; and two smaller streams, Spring Creek and Gilmore Creek, which drain the extreme northwestern part of Trimble County.

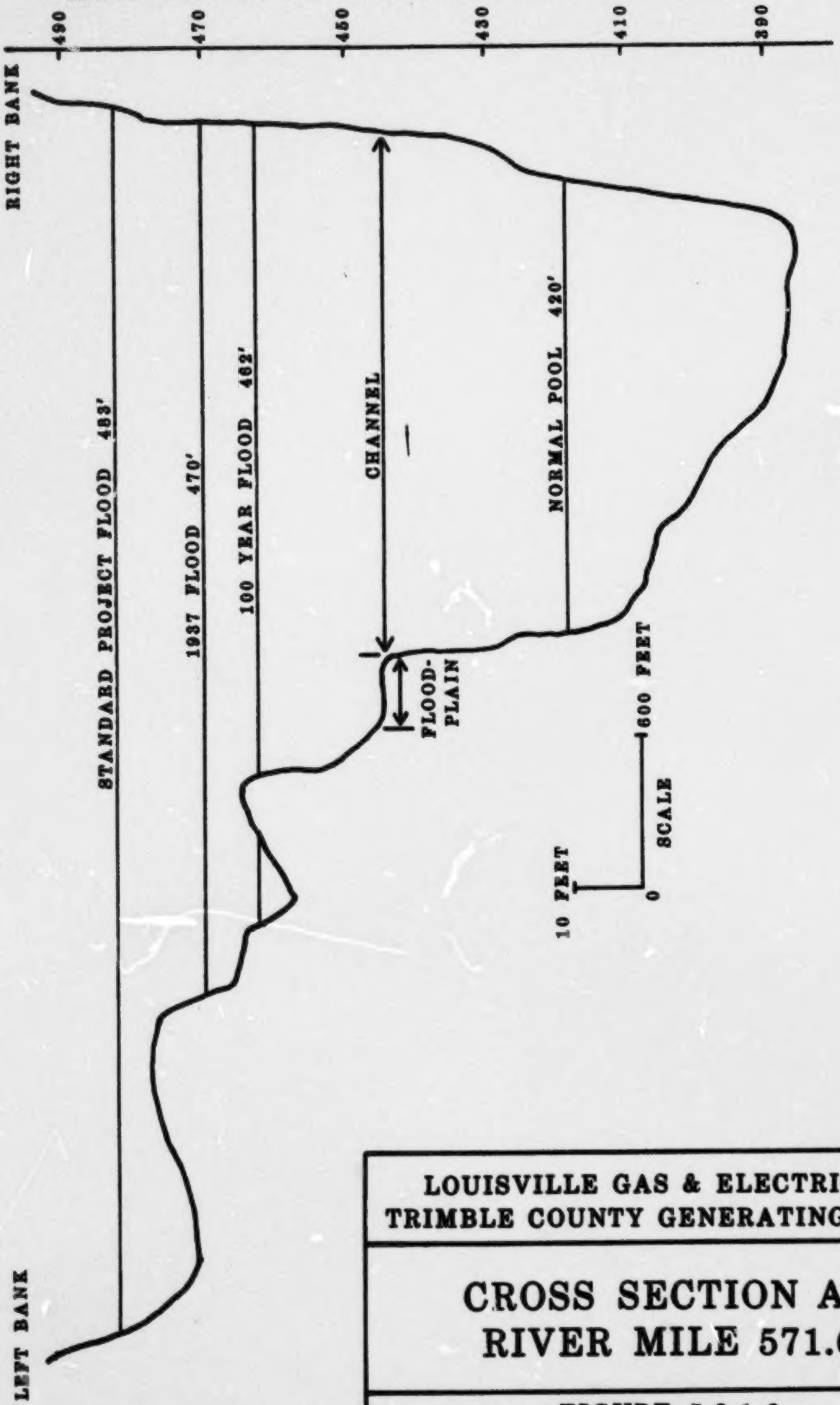
The Trimble County plant site is drained principally by the Ohio River. A portion at the northern end is drained by Corn Creek, and a portion at the southern end is drained by Barebone Creek.

The Corn Creek watershed has a dendritic pattern with three principal tributaries, Pryors Fork, Hughes Branch, and Furnace Branch, covering a total area of about 31 square miles. Corn Creek originates at an elevation of about 850 feet above mean sea level, just west of U.S. Highway 421. Below the mouth of Pryors Fork, Corn Creek meanders for about 4 miles through relatively flat bottomland. Immediately above the plant site, Corn Creek meanders in a 1,000-foot-wide alluvial plain and discharges to the Ohio River at River Mile 570.5 and at elevation 420 feet mean sea level. Prior to 1950, the lower portion of Corn Creek was channelized, leaving a half-mile-long cutoff oxbow whose water level rises and falls with that of the Ohio River at the northern end of the plant site.

Barebone Creek is the second, but relatively minor, watershed adjoining the plant site. The headwaters of this intermittent creek are near the outskirts of Bedford (see Figure 5.3.1-4). It flows almost due west for about 4 miles until it reaches the upper terrace at the plant site. Barebone Creek also flows through a wide alluvial flood plain. At the plant site, Barebone Creek meanders off to the south and west around Wises Landing before entering the Ohio River at River Mile 573. Barebone Creek watershed drains a 14-square-mile area; the creek falls from an elevation of about 850 feet near Bedford to an elevation of 420 feet at McAlpine Pool. Above the plant site, the creek is dry during extended rainless periods, which typically occur in the fall.

No historical data are available for average and peak flows in Corn and Barebone Creeks. Staff gauges have been placed at seven creek sampling stations, and discharge rates have been recorded twice monthly during 1975. These data are reported in Table 5.3.1-2.

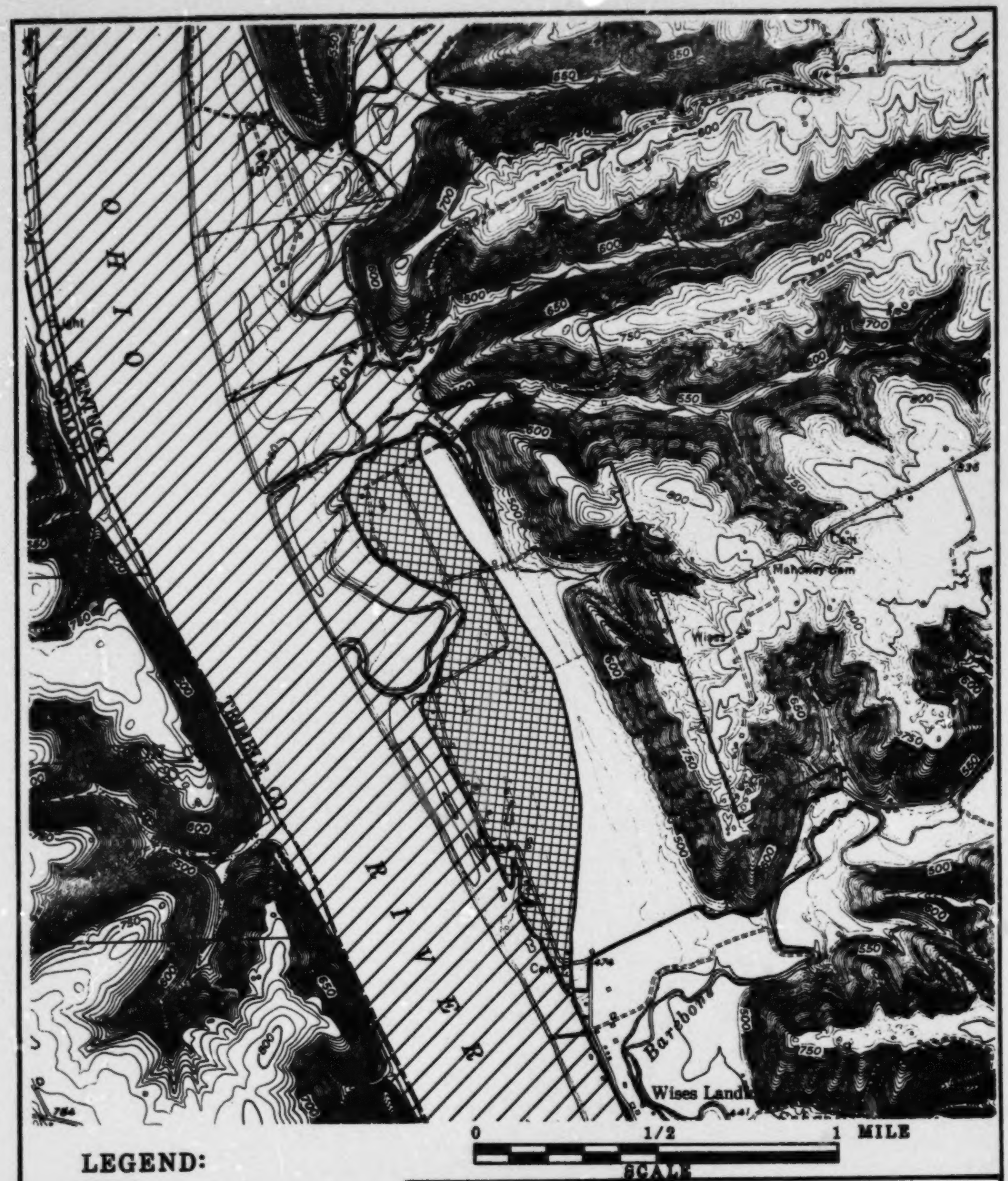
Estimated values for average and peak flows in Corn and Barebone Creeks may be determined from the characteristics of other streams in


ELEVATION, FEET ABOVE MEAN SEA LEVEL (1929 DATUM)
490
470
450
430
410
390
RIGHT BANK
LEFT BANK
STANDARD PROJECT FLOOD 483'
1937 FLOOD 470'
100 YEAR FLOOD 462'
CHANNEL
NORMAL POOL 420'
FLOOD-PLAIN
SCALE
0
10 FEET
600 FEET

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

CROSS SECTION AT RIVER MILE 571.6

FIGURE 5.3.1-2


OHIO
RIVER
KENTUCKY
INDIANA
TRIMBLE CO
Mahoney Cem
Wises
Barebone
Wises Landi
0
1/2
1 MILE
SCALE

LEGEND:

▨ 100 YEAR FLOOD

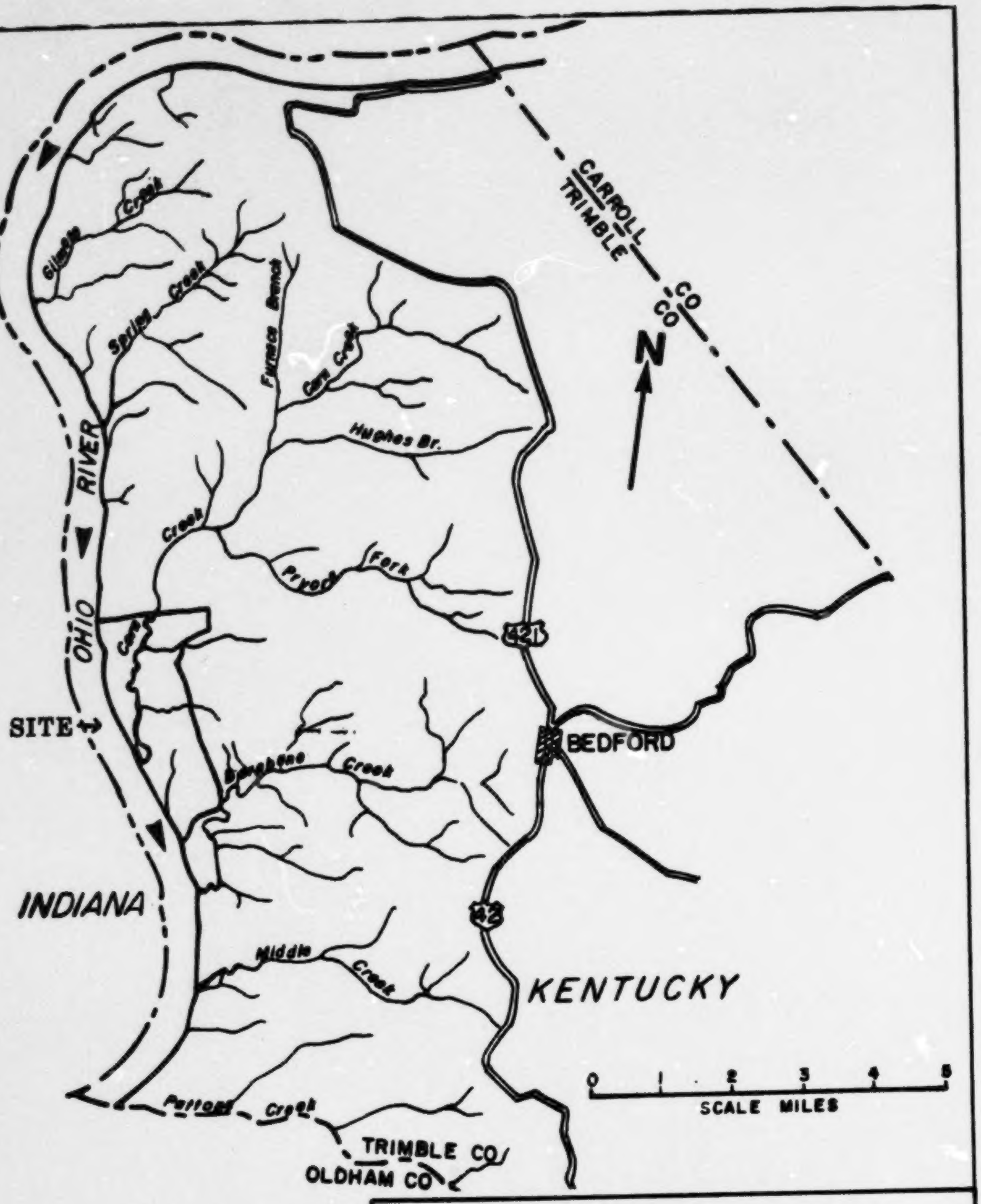
▦ 1937 FLOOD

N

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

AREAL EXTENT
OF FLOODING

FIGURE 5.3.1-3


CARROLL CO
TRIMBLE CO
N
Gilmore Creek
Spring Creek
Furnace Branch
Cane Creek
Hughes Br.
Creek
Pryors Fork
OHIO RIVER
Cane
SITE
Barebone Creek
BEDFORD
421
42
INDIANA
Middle Creek
KENTUCKY
0 1 2 3 4 5
SCALE MILES
Patton Creek
TRIMBLE CO
OLDHAM CO

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

SITE VICINITY STREAMS

FIGURE 5.3.1-4

Source: Fluor Pioneer Inc., 1975

TABLE 5.3.1-2

TRIMBLE COUNTY GENERATING PLANT
SITE DRAINAGE AND PEAK DISCHARGE

	Drainage Area Onsite (Acres)	Drainage Area Total (Acres)	Principal Drainageway Length (Feet)	Principal Drainageway Slope (Ft./100 Ft.)	Peak Discharge 10-Year Rainfall (cfs)
Ohio River					
Drain A[a]	165	165	6400	0.36	
B	60	67	3600	0.56	
C	141	141	5000	0.78	
Other	56	56	-	-	
(Subtotal)	(422)	(429)			225
Corn Creek					
Main Stream	67	18,345	55,500	0.92	
Tributary A	108	660	13,500	3.33	
B	58	780	12,800	3.40	
C	106	215	6,500	5.66	
(Subtotal)	(339)	(20,000)			95
Barebone Creek					
Main Stream	23	7539	34,200	1.42	
Tributary	226	266	6,800	0.51	
Other	-	1395	-	-	
(Subtotal)	(249)	(9200)			80
TOTAL	1010	29,629			400

---

[a] See Figure 5.3.1-5

northern Kentucky for which data are available (Table 5.3.1-3). Corn Creek is similar to Harrods Creek in topography, geographic location, and soil cover, but is larger and has a drainage pattern similar to Pond Creek. On this basis, an average yield of 1.5 cfs per square mile has been estimated, resulting in a mean annual flow of 51 cfs. Barebone Creek exhibits characteristics similar to Harrods Creek, and the flow rate is estimated at 1.65 cfs per square mile, resulting in an average flow of 23 cfs.

Estimates of peak discharge were made by using the annual peak discharge of Bear Grass and Pond Creeks for their periods of record and developing frequency curves by total drainage area using the Regional Analysis Method (U.S. Department of Agriculture, n.d.). This results in a 2-year peak of 1,400 cfs and a 10-year peak of 2,400 cfs for Corn Creek. For Barebone Creek, the estimated 2-year peak discharge is 1,100 cfs and the 10-year is 2,200 cfs.

Surface stormwater runoff from the site flows to the Ohio River, Corn Creek, and Barebone Creek. The size and location of the drainage areas on the site are shown on Figure 5.3.1-5. Most of the site consists of silty and loamy alluvial soils, much of this in cultivation, with moderate to slow permeability. The remainder of the site is wooded, steeply sloping hillside with moderately slow permeability and a high runoff potential.

Average annual runoff in the region is about 16 inches. Peak runoff from the site in its present, relatively undeveloped state has been determined by the Regional Analysis Method (U.S. Department of Agriculture, 1972d). Drainage-area characteristics are listed in Table 5.3.1-2. The peak discharge from the approximately 1,000-acre site is 400 cfs for a rainfall occurring an average of once every 10 years.

Hydrologic Characteristics (Surface Waters): Ravines RA and RB

Two tributary streams drain Ravines RA and RB into Corn Creek. These streams tend toward a low-flow or an intermittent condition. North Creek (RA), which is about 3.3 feet wide and 0.6 to 1.3 feet deep, appears to form relatively small, shallow pools in dry weather. South Creek (RB) is 3.3 to 6.6 feet wide and averages 1.7 feet in depth. It appears to have a more constant flow, but it also probably tends to form long, shallow pool areas in dry periods. The South Creek flow seems to be augmented by seepage from exposed water-bearing strata along the faces of the ravine. Both of the ravines present a fairly steep gradient (167 feet and 170 feet per mile), as evidenced by the cuts incised into the bluff rising above the upper river terrace (about 450 to 490 feet above MSL). Due to this gradient and the rock strata, the stream bed is composed of gravel and rubble from the ravine faces.

TABLE 5.3.1-3

SELECTED CHARACTERISTICS OF STREAMS IN NORTHERN KENTUCKY

Stream	Drainage Area (sq mi)	Average Discharge		Maximum Flood (cfs)	Years of Record	Mean Annual Flood (cfs)	Years of Record
		(cfs)	(cfs/sq mi)				
Harrods Creek (LaGrange)	24.1	39.9	1.66	5,320	6	-	-
Pond Creek (Louisville)	64.0	86.2	1.35	8,020	30	1,650	16
Middle Fork Beargrass Creek (Louisville at Cannons Lane)	18.4*	24.9	1.35	5,200	30	1,390	16
Kentucky River (Lockport)	5,980*	8,227	1.38	123,000	49	75,000	76

*Area contributing to runoff

Sources: U.S. Geological Survey, 1974; McCabe, 1962

Hydrologic Characteristics (Surface Waters): Transmission Line Corridors

The Kentucky transmission line route will cross Barebone Creek; the preliminary transmission line corridor in Clark County, Indiana, includes four streams: an unnamed tributary of Squaw Creek, Little Camp Creek, Camp Creek, and Fourteen Mile Creek. Because the transmission line routes will not impact the hydrologic characteristics of any of the streams they will or might cross, these characteristics are not discussed herein.

Hydrologic Characteristics (Ground Water): Plant Site and Ravines RA and RB

The principal ground water source at the proposed plant site is the sand and gravel outwash unit underlying the flood plain portion of the property. The sand and gravel aquifer begins at the valley wall on the east side of the property and extends westward beneath the channel of the Ohio River. The aquifer extends to the top of bedrock and has a saturated thickness of about 80 feet.

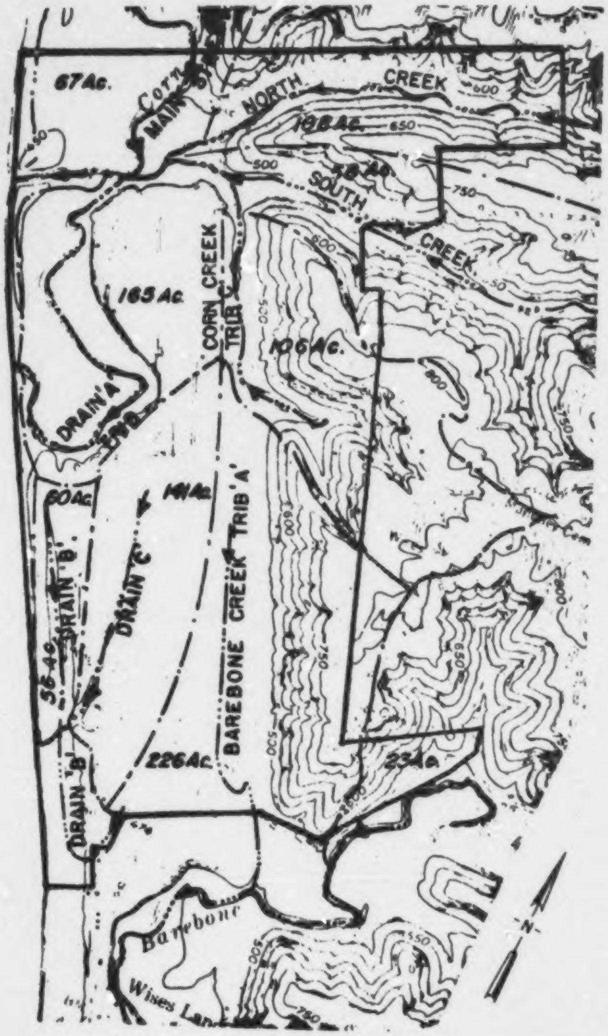
A large volume of ground water may be economically obtained from the sand and gravel aquifer underlying the Ohio River flood plain. Because of the high development potential of this aquifer, virtually no surface water is used for domestic, municipal, industrial, or agricultural consumption within 10 miles of the plant site.

Most of the regional population is served by ground water obtained from seven well fields and pumping centers located along the Ohio River flood plain. The municipal well fields are identified on Table 5.3.1-4, and the service area for each distribution system is listed on Table 5.3.1-5. Each pumping center has at least two or three wells, including one that is maintained for standby or emergency use. Normally, only one well is in operation at each well field.

Bedrock is not a significant ground water source in the immediate vicinity of the plant site. Domestic wells may obtain adequate supplies of 100 to 500 gallons per day along valley bottoms. Throughout most of the upland area, drilled wells usually produce less than 100 gallons per day and are inadequate for domestic supplies. Along valley slopes and narrow ridgetops, the ground water yield is almost negligible. Generally, ground water becomes saline very rapidly with increasing well depth; thus, most bedrock wells yielding fresh water are less than 100 feet deep.

The water-bearing characteristics of bedrock aquifers are presented in stratigraphic sequence on Figure 5.3.1-6.

Ground water levels measured at the plant site during August and September 1975 indicate that ground water is at elevation 421±, or about 1 foot above the minimum elevation of the river pool level. The ground water elevation of 421 should be considered as a minimum static level that may increase during an extended period of precipitation or in response to flood stages of the Ohio River. A monitoring program by the U.S. Geological Survey is currently in progress to assess the effects of both precipitation and flood stages on ground water levels at the site.


67 Ac.
Corn
MAIN ST.
NORTH CREEK
168 Ac.
600
650
500
58 Ac.
SOUTH CREEK
750
165 Ac.
CORN CREEK TRIB 'C'
106 Ac.
800
DRAIN 'A'
60 Ac.
141 Ac.
DRAIN 'B'
DRAIN 'C'
BAREBONE CREEK TRIB 'A'
56 Ac.
226 Ac.
23 Ac.
Barebone
Wises Lane
550
N

Source: Fluor Pioneer Inc., 1975

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

SITE DRAINAGE

FIGURE 5.3.1-5

TABLE 5.3.1-4

MUNICIPAL WELLS IN THE REGION SURROUNDING THE
TRIMBLE COUNTY GENERATING PLANT

Pumping Center	Population Served	Number of Wells	Average Depth (ft)	Average Daily Use (mgd)	Maximum Daily Use (mgd)
Indiana					
Charlestown	5,700	2	78	1.10	1.40
Hanover College (in Hanover)	1,700	3	65	0.30	0.43
Madison	11,600	6	114	1.70	2.50
East Well Field		2	98	2.50	3.70
West Well Field		2	108	1.10	1.80
Madison State Hospital		2	137	1.40	1.90
Washington Township Water Corporation (in New Washington)	1,125	3	63	0.13	0.17
Kentucky					
Milton	450	2	NA	NA	0.20
Trimble County Water District No. 1 (in Bedford)	453	2	68-71	0.12	0.24
Henry County Water District No. 2	3,400	3	99-105	0.58	NA

NA = Not Available

Sources: Public Service Indiana, 1975, page 2.5-30; Mull, et al., 1971.

TABLE 5.3.1-5

COMMUNITIES AND AREAS SERVED BY MUNICIPAL GROUND WATER PUMPING CENTERS IN THE TRIMBLE COUNTY GENERATING PLANT SITE REGION

Madison

Blocher
Chelsea
Kent
Lexington
Madison
Midway
Paynesville
Saluda
Smyrna
Volga
Wakefield
Wirt
Rural

Hanover College

Hanover
Rural

Milton

Milton
Rural

Charlestown

Charlestown
Marysville
Otisco
Nabb
New Market
Rural

Washington Township Water Corporation

New Washington
Otto
Solon
Vesta
Rural

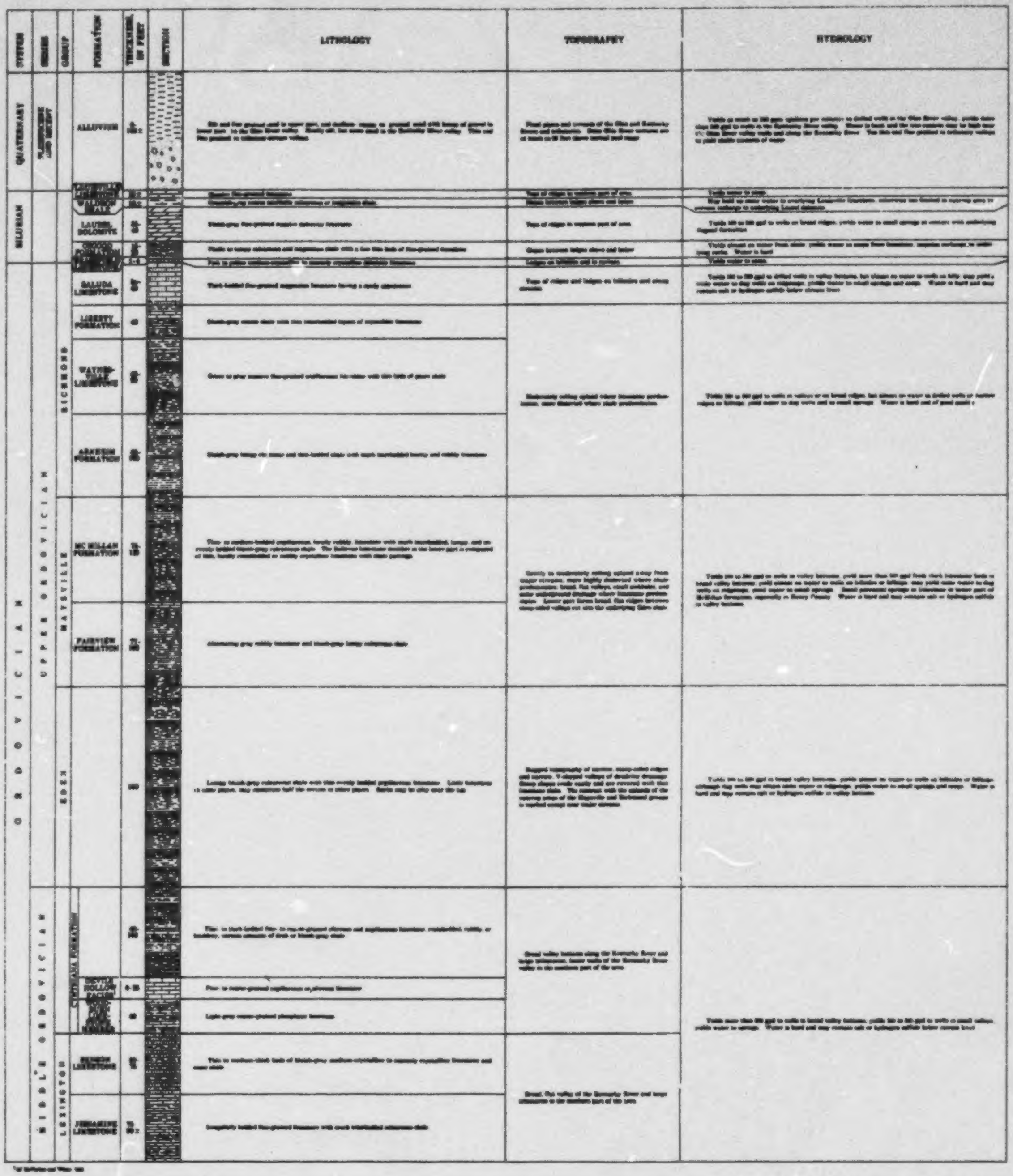
Trimble County
Water District No. 1

Bedford
Rural

Henry County
Water District No. 2

Campbellsburg
New Castle
Rural

Source: Public Service Indiana, 1975, page 2.5-30


SYSTEM
SERIES
GROUP
FORMATION
THICKNESS, IN FEET
SECTION
LITHOLOGY
TOPOGRAPHY
HYDROLOGY
QUATERNARY
ALLUVIUM
SILURIAN
LAUREL DOLOMITE
SALUDA LIMESTONE
LIBERTY FORMATION
WAYNESVILLE LIMESTONE
ARNHEIM FORMATION
RICHMOND
MC MILLAN FORMATION
FAIRVIEW FORMATION
MAYSVILLE
EDEN
UPPER ORDOVICIAN
ORDOVICIAN
DEVILS HOLLOW FACIES
MIDDLE ORDOVICIAN
LEXINGTON
JESSAMINE LIMESTONE

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LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

GENERALIZED COLUMNAR SECTION
AND WATER CHARACTER
CARROLL, GALLATIN, HENRY, OWEN,
TRIMBLE COUNTIES, KENTUCKY

FIGURE 5.3.1-6

Source: Hall and Palmquist, 1960b

The alluvial aquifer is normally recharged by direct infiltration of precipitation and by seepage along the valley walls. The hydraulic connection is generally good along many portions of the Ohio River; therefore, stream bed infiltration can recharge the aquifer during river flood stages. Stream bed infiltration may also be induced by placing water wells in close proximity to the river. However, a blanket of silt often can occur at the bottom of the river, effectively inhibiting recharge from passing through the bed of the river and into the aquifer. The actual degree of hydraulic communication between the Ohio River and the outwash aquifer at the plant site is presently under study by the U.S. Geological Survey.

Hydrologic Characteristics (Ground Water): Transmission Line Corridors

The ground water characteristics of the Kentucky transmission line right-of-way are expected to be similar to those identified for the plant site and ravines.

The preliminary transmission line corridor in Clark County, Indiana crosses one aquifer type and encroaches upon a second.

From the west bank of the Ohio River to the western terminus of the corridor, a thin veneer of glacial till and weathered bedrock surface together form a minor aquifer. Most wells tapping this aquifer are less than 150 feet deep, and the yield (0 to 10 gpm) is barely adequate for domestic or farm supplies. Wells rarely exceed 150 feet because yield does not increase in the unfractured rock, and the ground water becomes brackish at these depths. Along this portion of the corridor, recharge is derived solely from the infiltration of precipitation. Where surficial glacial till covers the bedrock, ground water may migrate in sand lenses within the till. While the sound bedrock is virtually impermeable, some ground water migrates along enlarged joints or cracks in the upper weathered zone.

A small, but significant aquifer exists near the western terminus of the preliminary corridor. This aquifer is composed of stratified drift, a body of sand and gravel 65 feet thick which was deposited during the Illinoian glacial period. The stratified drift aquifer lies on a NW-SE trend, about 3/4-mile west of the proposed tie-in point. Three wells draw 100 to 300 gpm each from the southern end of this aquifer to provide ground water to the Washington Township Water Corporation distribution system.

5.3.2 Water Quality

Ohio River

Apparently, no studies have been made of the water quality of the Ohio River in the immediate vicinity of the Trimble County Generating Plant site. Studies of the water quality of the Ohio River have been performed upstream and downstream of the plant site and provide general information on the physical and chemical parameters of the region.

Perhaps the best references to the water quality of the Ohio River are the annual reports of the U.S. Public Health Service Water Pollution Control Administration, the Environmental Protection Agency, and the Ohio River Valley Water Sanitation Commission. Records of discharge are available from the records of the U.S. Geological Survey. Such records provide information on the vagaries of the Ohio River's water quality. For example, in the Ohio River at Louisville, Water Year 1966 to 1967, such physical and chemical parameters as temperature, dissolved oxygen, pH, carbonate alkalinity, turbidity, and total dissolved solids showed differences in ranges and means (Table 5.3.2-1). Table 5.3.2-2 compares 1976 data collected by the Ohio River Valley Water Sanitation Commission's monitoring program with U.S.G.S. water quality data collected in 1969 and 1970. The right hand column of the table lists Kentucky water quality standards. Table 5.3.2-3 presents monthly data collected in 1976; these data are also compared to Kentucky standards.

For the present study, three transects (see Section 5.3.4) were established by the University of Kentucky's Water Resources Laboratory on the Ohio River to determine water quality. The results are presented in Tables 1 through 8 (Appendix O). The lower hardness and alkalinity values and lower cation (particularly calcium and magnesium) concentrations seem to be a function of the greatly increased discharge volume. The increases in chloride and sulfate concentrations in the river are probably the result of natural and man-mediated (industrial and domestic) causes. More than 1,600 industries and 130 sewage treatment plants are discharging organic compounds, heavy metals, high BOD wastes, and fecal organisms into the main stem and tributaries of the Ohio River.

Corn and Barebone Creeks and the Oxbow

Natural surface waters other than the Ohio River on or near the site consist of Corn and Barebone Creeks and an "oxbow" area, which was formed when the lower half of the flood plain portion of Corn Creek was rechanneled, probably back in the 1930's. The oxbow area is supplied with water by flooding from the Ohio River and by seepage from Corn Creek and the Ohio. The water quality of both creeks and the oxbow area (Station 7--see Figure 5.3.4-1) was sampled during the aquatic survey.

Tables 9 through 17, Appendix O, summarize the 1975 physical and chemical characteristics of the waters of Corn and Barebone Creeks and the oxbow (see Section 5.3.4, Figure 5.3.4-1 for a map of sampling locations). Sampling was conducted bi-monthly from May through December. Table 18, Appendix O, contains the results of the samples taken in February, March, and April of 1976.

TABLE 5.3.2-1

MINIMUM, AVERAGE, AND MAXIMUM VALUES FOR DIFFERENT PHYSICAL AND CHEMICAL PARAMETERS OF OHIO RIVER WATER AT LOUISVILLE, KENTUCKY FOR 1966 AND 1967 WATER YEARS

		Temperature (°C)	Dissolved oxygen (mg/1)	pH	Alkalinity ($CaCO_3$) (mg/1)	Turbidity (JTU)	Total dissolved solids (mg/1)	Discharge cfs (thousands)
	Minimum	0.3	1.7	7.2	46	25	137	7.6
1966	Average	14.2	8.5	7.5	66	80	290	80.6
	Maximum	28.9	12.1	7.9	79	550	478	515.0
	Minimum	2.2	2.7	7.1	40	25	138	10.9
1967	Average	14.9	7.8	7.5	59	115	256	116.5
	Maximum	27.8	13.3	7.8	88	750	414	642.0

Source: U.S. Department of the Interior, 1966 and 1967b

TABLE 5.3.2-2

OHIO RIVER WATER QUALITY
(RIVER MILE 600.6)
TRIMBLE COUNTY GENERATING PLANT

Parameter	ORSANCO Manual Program Water Year 1976[a]				USGS Water Quality Records Water Years 1969 and 1970[b]				Kentucky Water Quality Standards
	No. of Samples	Mean	Minimum	Maximum	No. of Samples	Mean	Minimum	Maximum	
TSS (mg/1)	26	59	1	437	-	-	-	-	-
TDS (mg/1)	14	209	152	324	24	286	190	478	750
Alk. ($CaCO_3$) (mg/1)	14	64	46	81	24	73	38	128	-
SO_4 (mg/1)	27	65	23	100	69	97	42	208	-
Cl (mg/1)	14	19	12	31	71	41	12	84	-
F (mg/1)	14	0.2	0.1	0.6	47	0.4	0.1	0.8	1,000
Hard. (Ca, Mg) (mg/1)	14	136	120	160	71	165	90	244	-
Ca (mg/1)	14	38	32	46	-	-	-	-	-
Mg (mg/1)	14	9.8	8.5	12	-	-	-	-	-
Na (mg/1)	19	15.5	8.6	27	-	-	-	-	-
K (mg/1)	14	2.7	1.9	3.7	-	-	-	-	-
SiO_2 (mg/1)	14	5.8	3.8	6.5	-	-	-	-	-
Phenol (mg/1)	27	1.2	0	7	-	-	-	-	-
CN (mg/1)	27	0	0	0.01	-	-	-	-	0.025
BOD_5 (mg/1)	5	1.2	0.7	1.7	-	-	-	-	-
TOC (mg/1)	14	5.1	1.8	13	-	-	-	-	-
P-total (mg/1)	27	0.11	0.05	0.59	69	0.16	0.02	0.55	-
TKN (mg/1)	27	0.67	0.08	4.2	-	-	-	-	-
NH_3-N (mg/1)	27	0.10	0	0.19	-	-	-	-	-
NO_3-N (mg/1)	23	1.07	0.32	1.7	72	2.5	0.8	5.0	-
As (μg/1)	2	1	1	1	23	0.9	0	10	50
Ba (μg/1)	10	44	0	200	-	-	-	-	1,000
Cd (μg/1)	10	0.7	0	2	23	1.3	0	11	10
Cr (μg/1)	10	<15	<10	40	23	4	0	10	50
Cu (μg/1)	10	11.4	2	53	23	12	0	40	-

TABLE 5.3.2-2 (Continued)

	ORSANCO Manual Program Water Year 1976				USGS Water Quality Records Water Years 1969 and 1970				Kentucky Water Quality Standards
Parameter	No. of Samples	Mean	Minimum	Maximum	No. of Samples	Mean	Minimum	Maximum	
Fe (µg/1)	10	2,764	210	15,000	63	544	40	2,500	-
Pb (µg/1)	10	23	7	44	23	10	0	77	50
Mn (µg/1)	10	210	30	1,300	63	202	60	710	-
Hg (µg/1)	10	0.08	0	0.2	-	-	-	-	-
Ni (µg/1)	10	13	3	40	23	9	0	59	-
Se (µg/1)	2	0.05	0	1	-	-	-	-	10
Ag (µg/1)	10	0.1	0	1	-	-	-	-	50
Zn (µg/1)	10	57	20	170	23	28	10	90	-
Coli.-fec./100 ml	15	335	16	900	-	-	-	-	-
Coli.-tot./100 ml	16	4,678	120	13,500	-	-	-	-	20,000

---

[a] Ohio River Valley Water Sanitation Commission, 1976

[b] U.S. Department of the Interior, 1969 and 1970

TABLE 5.3.2-3

MONTHLY OHIO RIVER (RIVER MILE 600.6) PHYSICAL AND CHEMICAL DATA, ORSANCO[a] ROBOT MONITOR WATER YEAR 1976 TRIMBLE COUNTY GENERATING PLANT

	Monthly Average Value				
Month	Dissolved Oxygen (mg/l)	Temperature[b] (°F)	pH[c]	Conductivity (µmhos/cm)	Flow (1000 cfs)
October	7.5	62 (78)	6.9	310	99
November	8.4	56 (70)	7.0	330	68
December	10.7	45 (57)	7.3	340	124
January	11.9	40 (50)	7.2	270	217
February	10.9	42 (50)	7.3	290	233
March	10.2	52 (60)	7.1	290	174
April	9.4	58 (70)	7.2	300	98
May	7.3	66 (80)	7.3	420	46
June	6.0	73 (87)	6.8	430	58
July	5.2	80 (89)	6.9	410	66
August	5.4	80 (89)	6.9	380	40
September	5.2	76 (87)	7.0	460	26
Minimum	5.2	40	6.8	270	26
Maximum	11.9	80	7.3	460	233
Mean	8.1	61	7.1[d]	353	105
Kentucky Standards	5.0[e]	Presented Above	6.0-9.0	1200	-

---

[a] Ohio River Valley Water Sanitation Commission, 1976

[b] Values in parentheses are Kentucky maximum temperature standards.

[c] Standard units.

[d] Median value.

[e] Daily average.

Water quality in Corn and Barebone Creeks is typical of limestone streams in north-central Kentucky. The water is hard, with a total alkalinity of 175 to 250 ppm ($CaCO_3$). When stream discharges decrease in early summer and the streams begin to "pool," total alkalinity may increase as evaporation tends to concentrate solutes in these pools. The difference between the total alkalinity of the tributary streams and the Ohio River is considerable. Total alkalinity of the Ohio River is about 50 ppm, whereas the total alkalinity of the tributary streams is a five-fold increase in these values.

The cation balance of Corn and Barebone Creek waters is also typical of most streams in Kentucky. Calcium is the predominant cation, followed by magnesium, sodium, and then potassium. This cation balance tends to lead to water that is well buffered and protects the stream biota from shifts in pH. The waters of Corn and Barebone Creeks are slightly alkaline in pH, ranging from 7.4 to 8.8.

Iron concentrations in the two streams are lower than iron concentrations usually occurring in streams of this region. Concentrations of iron in excess of 2.0 ppm in water may cause staining and objectionable taste.

The anions encountered in Corn and Barebone Creeks are in concentrations found in most of the regional streams. Nitrate, nitrite, and phosphate values show some seasonal variations, but their values are well within the range of concentrations found in other streams of the area.

Chloride and sulfate are present in somewhat higher concentrations than would be expected. Water hardness and the presence of higher concentrations of magnesium probably contribute to the higher chloride and sulfate values. These values are still within the expected range of variation.

Specific conductance values confirm the total electrolyte concentrations in micromhos. These conductance values of 400-600 micromhos are commonly obtained from streams of the region, and they further attest to the hard water and ionic distribution in the streams.

In general, the water quality of Corn and Barebone Creeks is good; it does, however, show some of the effects of the intensity of agricultural activity in the area. Although water in the two creeks is not present in great quantities during all seasons, it could serve for industrial use. However, it is much too hard for use as boiler water without a water-softening process.

Chemical analyses of the stream sediments (Table 5.3.2-4) show increases in potassium levels that probably reflect agricultural activity in the area. Potentially toxic metals such as chromium, copper, lead, and manganese are not present in quantities that might be harmful or dangerous. Iron concentrations in the sediments are the result of iron in its oxidized, insoluble state (Fe^{+++}). The presence of oxidized iron would enrich the sediments and account for these higher values.

TABLE 5.3.2-4

CHEMICAL ANALYSIS OF SEDIMENTS FROM CORN CREEK, BAREBONE CREEK, AND THE OXBOW, TRIMBLE COUNTY GENERATING PLANT SITE, SEPTEMBER 1975[a]

Station[b]	Na	K	Ca	Mg	Fe	Mn	Cu	Cr	Zn	Pb
1	3.7	15.7	791.6	10.2	24.6	1.4	0.02	0.04	0.07	0.02
2	1.1	4.8	202.8	5.9	14.1	0.8	0.01	0.02	0.01	0.01
3	3.6	3.2	169.1	4.2	29.3	1.3	0.01	0.03	0.03	0.02
4	4.0	12.3	62.1	10.9	19.6	0.8	0.02	0.04	0.05	0.01
5	0.7	31.2	159.3	3.2	22.6	1.5	0.01	0.05	0.03	0.02
6	5.5	7.2	79.1	15.0	10.8	0.5	0.01	0.02	0.03	0.01
7	3.0	21.5	14.9	6.5	35.4	1.2	0.06	0.1	0.3	0.03

---

[a] All values are in milligrams/gram of dry sediment.

[b] See Figure 5.3.4-1.

Source: University of Louisville, 1975a.

Ravines RA and RB

The streams in Ravines RA and RB were sampled by the University of Louisville Consultants in February, March, and April 1976. For the purpose of this report, the stream in Ravine RA was designated North Creek, and the stream in Ravine RB was designated South Creek. Sampling stations were established at the mouth of each ravine (elevation 440 feet in Ravine RA and elevation 450 feet in Ravine RB). The location of these stations is presented in Section 5.3.4, Aquatic Biota, on Figure 5.3.4-1.

During periods of low flow, pooling takes place in North and South Creeks. During the survey, the stream flow of the creeks was diminished. This, combined with the effect of seepage from aquifers and evaporative losses, resulted in increased Ca^{++} and Mg^{++} concentrations, along with bicarbonate and sulfate concentrations. Compared with Corn Creek during the same sampling period (see Appendix O, Table 18), the waters of North and South Creeks were more mineralized, with greater total alkalinity than Corn Creek water.

Transmission Line Corridors

The Kentucky transmission line right-of-way will cross Barebone Creek, which is discussed in the preceding paragraphs.

Four streams in Clark County, Indiana, fall within the preliminary transmission line corridor: an unnamed tributary of Squaw Creek, Little Camp Creek, Camp Creek, and Fourteen Mile Creek. Although no data are available for these streams within the corridor, some data on the water quality of Fourteen Mile Creek from the lower half of the drainage are available and are presented in the following table (sample locations refer to Figure 5.3.2-1):

WATER QUALITY DATA, FOURTEEN MILE CREEK,
CLARK COUNTY, INDIANA, SEPTEMBER, 1973

	Location 1	Location 2
Temperature (°C)	28	28
DO (mg/1)	7.5	5.8
Conductivity (μmhos/cm x 10^2)	4.0	4.0
Total COD_5 (mg/1)	71	130
Orthophosphate (mg/1)	0.1	0.15
Total Coliform (organisms/100 ml)	1,000	1,000
pH	8.2	7.7

Source: Schimpeler-Corradino Associates, 1974.

None of these values violates Indiana water quality standards.

Ground Water of the Plant Site and Ravines

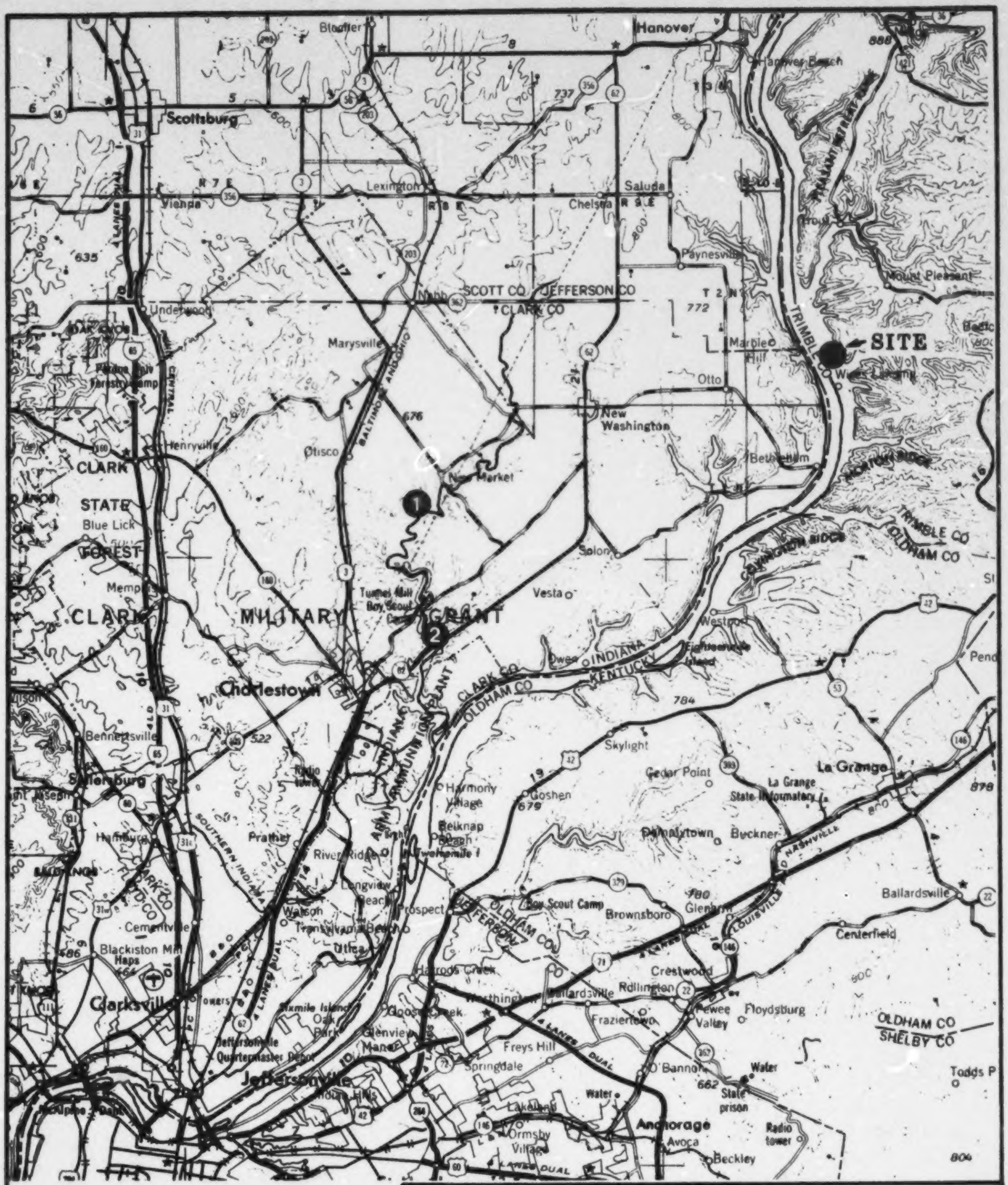
Ground water produced from the sand and gravel aquifer underlying the Ohio River flood plain is generally of the calcium-magnesium bicarbonate type. The water is classified as very hard and may contain iron in objectionable concentrations. The concentration of sulfate is usually significant, ranging from about 20 to 70 mg/l. Sodium and chloride concentrations are quite variable, but usually low. These conclusions are based on the general characteristics that have been determined for the Ohio River alluvial aquifer and from the available chemical analyses of ground water in the vicinity of the site as reported by the U.S. Geological Survey.

Ground water produced from the bedrock aquifer is usually of relatively poor quality, particularly from wells drilled deeper than 100 feet. Shallow wells that are fed primarily from weathered cracks in the upper bedrock surface produce water that is hard but of good chemical quality. Deeper wells that draw from permeable zones within the bedrock formations often produce water that contains sodium chloride or hydrogen sulfide in noticeable concentrations. Deep bedrock aquifers become more saline with increasing depth and eventually contain unpalatable brine.

One well at the Milton Hall farm, just north of the plant site, was tested for water quality in June 1975 by the University of Louisville Water Resources Laboratory. The results are presented in Table 5.3.2-5. The well is 12 years old, and, although the yield is not known, the well has never been dry. The well is located about 45 feet southeast of Mr. Hall's home.

The water of the Hall well is very hard, with higher conductance and electrolyte concentrations than the surface water of the area. The analysis shows a higher concentration of sodium than magnesium, indicating some increased chlorinity. This quantity does not seem sufficient to cause the water to be rejected for domestic purposes.

The quality of ground water in both the alluvial and bedrock aquifers was evaluated further by sampling selected wells during the water well inventory, conducted by Dames & Moore March 24-26, 1976. The results are presented on Table 5.3.2-6, and the locations are shown on Figure 5.3.2-2. The wells are described in Table 5.3.2-7. These analyses included determinations for heavy metals and toxic substances that are known to be present in some power plant ashes. All seven of the ground water samples analyzed showed that toxic elements (including arsenic, barium, boron, cadmium, chromium, lead, mercury, selenium, silver, and fluoride) are not present in detectable concentrations. Both iron and manganese were present in negligible concentrations except at Sampling Station No. 21, where both elements were found in objectionable amounts. The pH of all ground water samples tested ranged from 7.6 to 7.7. These and other chemical characteristics are typical of those known for ground water in the region.


SITE
1
2
Hanover
Scottsburg
Lexington
Saluda
Chelsea
Vienna
Underwood
Nabb
Paynesville
SCOTT CO
JEFFERSON CO
CLARK CO
Marysville
Marble Hill
Otto
New Washington
Henryville
Otisco
New Market
Bethlehem
CLARK
STATE
FOREST
Blue Lick
Memphis
MILITARY
GRANT
Charlestown
Vesta
Solon
Owen
INDIANA
KENTUCKY
TRIMBLE CO
OLDHAM CO
Mount Pleasant
Westport
Bennettsville
Sellersburg
Hamburg
Prather
River Ridge
Harmony Village
Belknap Beach
Skylight
Goshen
Cedar Point
La Grange
Buckner
Watson
Longview Beach
Transylvania Beach
Prospect
Utica
Cementville
Blackiston Mill
Clarksville
Brownsboro
Ballardsville
Centerfield
Crestwood
Harrods Creek
Worthington
Fraziertown
Pewee Valley
Floydsburg
OLDHAM CO
SHELBY CO
Goose Creek
Glenview Manor
Jeffersonville Quartermaster Depot
Jeffersonville
Indian Hills
Freys Hill
Springdale
O'Bannon
State prison
Lakeland
Ormsby Village
Anchorage
Avoca
Beckley
Radio tower
Todds Point

LEGEND:

① SAMPLING LOCATION

0 5 MILES

SCALE

N

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

WATER QUALITY SAMPLING LOCATIONS
FOURTEEN MILE CREEK
CLARK COUNTY, INDIANA

FIGURE 5.3.2-1

TABLE 5.3.2-5

WELL WATER ANALYSIS - MILTON HALL FARM[a]
TRIMBLE COUNTY GENERATING PLANT

Carbonate hardness	331	Iron	0.05
Noncarbonate hardness	-23	Manganese	0
Bicarbonate alkalinity	354	Sulfate	31.7
Carbonate alkalinity	0	Chloride	31.4
Temperature, °C	16.5	Phosphate	2.31
pH	7.2	Nitrite	0.003
Turbidity, NTU	0.2	Nitrate	0.66
Dissolved oxygen	2.2	Total residue	430
Conductivity (μmhos/cm^2)	750	Suspended solids	0
Calcium	75	Ammonia	0
Magnesium	35.0	COD	20
Sodium	43.0	BOD	0.2
Potassium	4.8	Silica	13.5

---

[a] Sample collected June 13, 1975. All measurements in mg/l unless otherwise noted. Turbidity was measured by means of a Hach Model 2100 A turbidimeter. A formazin polymer was used as a standard reference suspension. Results are expressed as nephelometer turbidity units or NTU. This procedure is outlined in Standard Methods, 13th ed., Sect. 163 A, p. 350-352 (American Public Health Association, 1971).

Source: University of Louisville, 1975a

TABLE 5.3.2-6

GROUND WATER QUALITY ANALYSES - DAMES & MOORE INVENTORY
MARCH 24-26, 1976
TRIMBLE COUNTY GENERATING PLANT

Chemical Parameter[b]	Water Well Inventory Number[a]						
	3	6	10	16	19	21	23
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	71.3	71.4	55.6	27.3	104	101	99.2
Chromium, Total	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Iron, Soluble	<0.02	<0.02	0.10	0.03	0.14	17.90	<0.02
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Magnesium	21.6	21.3	30.9	14.6	27.9	43.2	25.7
Manganese	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	0.02
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sodium	2.4	3.2	6.2	4.0	2.1	26.7	6.9
Alkalinity (as $CaCO_3$)	229	225	268	126	287	457	272
Chloride	2.7	7.4	2.1	2.1	2.1	4.3	9.0
Fluoride	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Hardness (as $CaCO_3$)	267	266	266	128	375	430	354
Nitrate (as N)	0.84	0.72	0.18	2.20	0.52	0.04	8.90
pH (units)	7.7	7.7	7.6	7.7	7.6	7.6	7.6
Sulfate	69.0	53.6	16.5	7.6	72.0	1.5	34.0
Total Dissolved Solids	292	296	258	106	392	389	358
Well Data[c]							
Name of Owner	P.V. Farm	C. Scott	B. Vest	M.T. Mahoney	M. Dean	L. Mahoney	P. Venard
Date Sampled	3/25/76	3/25/76	3/25/76	3/26/76	3/25/76	3/25/76	3/26/76
Principal Aquifer	Alluvium	Alluvium	Limestone	Limestone	Alluvium	Alluvium	Alluvium

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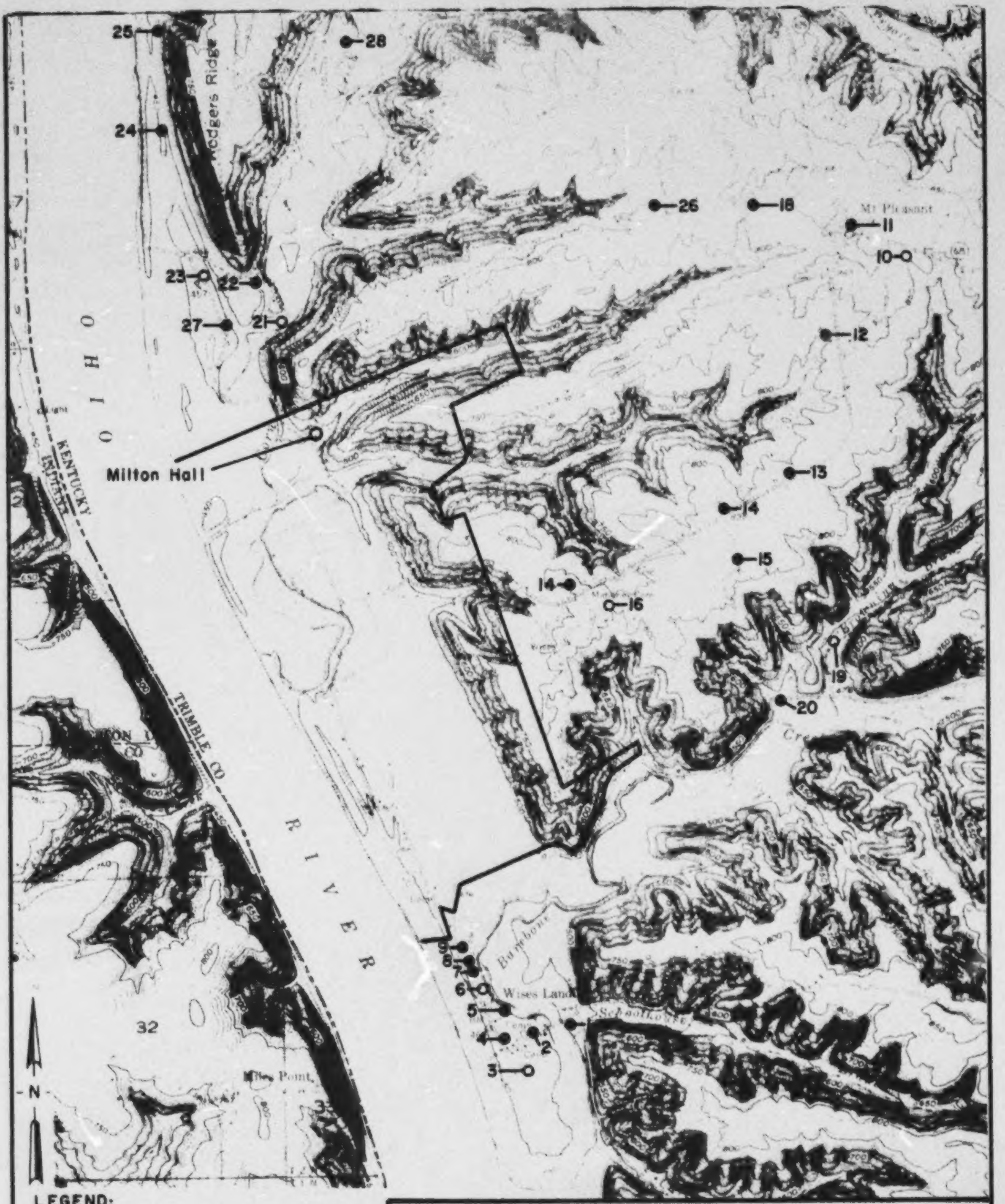
[a] See Figure 5.3.2-2 for location of sampling stations.
[b] All values expressed in mg/l unless otherwise noted.
[c] Additional physical well data are given on Table 5.3.3-1.


25
28
Rodgers Ridge
24
26
18
Mt Pleasant
11
10
23
22
27
21
12
OHIO RIVER
KENTUCKY
INDIANA
Milton Hall
13
14
15
14
16
19
20
TRIMBLE CO
9
8
7
6
Wises Landing
5
4
2
3
32
Miles Point
N
LEGEND:
32 Water well inventory number
● Inventory only
○ Inventory and chemical analysis
0
1/2
1
SCALE OF MILES

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

WATER WELL INVENTORY
LOCATION MAP

FIGURE 5.3.2-2

TABLE 5.3.2-7

WELL DATA - DAMES & MOORE
WATER WELL INVENTORY, MARCH 24-26, 1976

Map Location Code	Owner or Tenant	Location	Type of Well	Present Water Use	Date Drilled	Depth of Well	Depth to Water	Casing Type and Size	Casing Depth	Type of Pump	Softener or Demineralizer	Date Sampled	Approximate Land Surface Elevation	Topographic Situation	Principal Aquifer Unit
1	Trimble County	Barebone Creek, Wises Landing	Drilled	Municipal Supply	1956	71 ft.	~19 ft.[a]	8" steel	70 ft.[a]	30 HP	softened & chorinated	-	441 ft.	F	Quaternary alluvium
1A	Water District	"	Drilled	Municipal Supply	1956	68 ft.	~19 ft.[a]	8" steel	70 ft.[a]	30 HP	"	-	441 ft.	F	"
1B	No. 1	"	Drilled	Municipal Supply	1956	65 ft.	~19 ft.[a]	10" steel	70 ft.[a]	40 HP	"	-	441 ft.	F	"
2	Herman Schad	Barebone Road, Wises Landing	Drilled	Domestic	unknown	unknown	unknown	unknown	unknown	electric	none	-	~475 ft.	F	Qal
3[b]	Pleasant View Farm/ C. C. Fix Hiers	"	Drilled	Domestic, livestock	unknown	105 ft.[a]	33 ft. (reported)	6" steel	unknown	submersible	none	3/25/76	~475 ft.	F	Qal
4	Ivan Morgan	Route 754, Wises Landing	Drilled	Domestic, some stock	~1956	85-90 ft.[a]	40 ft.[a]	unknown/steel	unknown	electric	none	-	~475 ft.	F	Qal
5	Wayne Goode	"	Drilled	Domestic, some stock	~1966	106 ft.[a]	30 ft.[a]	6" steel	100 ft.	Flint & Walling	none	-	~475 ft.	F	Qal
6[b]	Clara Scott	"	Drilled	Domestic	1958	75 ft.[a]	38 ft.[a]	2" cast iron	unknown	Deming 1/2 HP	none	3/25/76	~475 ft.	F	Qal
7	Albert Scott	"	Drilled	Domestic	4/72	105 ft.[a]	38 ft.[a]	6" cast iron	105 ft.; screen from 105-108 ft.	Myers; prod. 17.5 gpm	none	-	~475 ft.	F	Qal
8	Leon Grossman	"	Drilled	Domestic	4/57	60 ft.[a]	38 ft.[a]	6" steel	screen 57-60 ft. 60 ft.	unknown	none	-	~475 ft.	F	Qal
9	Lewis Garriott	"	Drilled	Domestic	1972	~100 ft.[a]	unknown	8" cast iron	unknown	submersible	none	-	~475 ft.	F	Qal
10[b]	Bernard Vest	Route 625, Mt. Pleasant	Drilled	Domestic	1974	95 ft.[a]	14 ft.[a]	6" steel	(rock at 14 ft.) 14 ft.	Myers	none	3/25/76	~860 ft.	U	Silurian bedrock
11	Russell Tingle	"	Drilled	Domestic	~1958	98 ft.[a]	33 ft.[a]	6" steel	unknown	submersible	none	-	~859 ft.	U	Silurian bedrock
12	Everett Handlon	Ogden Ridge, Mt. Pleasant	Spring	Domestic	-	-	flow 2-3 gpm	-	-	electric, to house	none	-	~810 ft.	U	Silurian bedrock
13	unknown	"	unknown	Probably Domestic	unknown	unknown	unknown	unknown	unknown	hand	-	-	~830 ft.	U	Probably Silurian bedrock
14	Donald Tandy	"	Drilled	Abandoned	unknown	unknown	unknown	unknown	unknown	unknown	unknown	-	~835 ft.	U	
15	Howard Leach	"	Drilled	Domestic; supplements cistern	~1971	~70 ft.[a]	unknown	8"/unknown	15 ft.[a]	submersible	none	-	~840 ft.	U	Silurian bedrock
16[b]	M. Thomas Mahoney	"	Drilled	Domestic	Spring/70	75 ft.[a]	13 ft.[a]	6" steel	12 ft.[a]	submersible	none	3/26/76	~810 ft.	U	Silurian bedrock
17	Gilbert Heaton	"	Dug	Domestic, livestock	>50 years ago	~25 ft.[c]	14.2 ft.[c]	3 ft. rock lining	25 ft.[a]	electric	none	-	~800 ft.	U/H	Silurian bedrock
18	E. Johnson	Mt. Pleasant	Spring	Domestic	-	-	flow <1 gpm	-	-	gravity	none	-	~825 ft.	U	Silurian bedrock
19[b]	Margaret Dean	Browning Branch	Dug	Domestic	>100 years ago[a]	14 ft.[a]	~10 ft.[a]	3 ft. rock lining	14 ft.	electric	none	3/25/76	~490 ft.	V	
20	Betty Crawford	"	Dug	Domestic	unknown	15.2 ft.[c]	4.6 ft.[c]	3 ft. rock lining	15 ft.	electric	none	-	~475 ft.	V	
21[b]	Lloyd Mahoney	Corn Creek	Drilled	Domestic, livestock	3/19/76	72 ft.[a]	7.0 ft.[a]	6" steel	72 ft.	Flint & Walling	none	3/25/76	~445 ft.	F	Qal
22	Gale Mahoney	"	Driven	Domestic, livestock	5/58	81 ft.[a]	~25-30 ft.[a]	6" steel	81 ft.	Wayne Sub.	softener	-	~460 ft.	H	Qal
23[b]	Paul Venard	"	Drilled	Domestic, supplement for livestock	1963	60 ft.[a]	~30 ft.[a]	4" steel	60 ft.	Flint & Walling Sub.	ln. filter	3/26/76	~450 ft.	F	Qal
24	"	"	Drilled	Domestic	1976	75 ft.[a]	unknown	6" steel	75 ft.	none yet	none	-	~450 ft.	F	Qal
25	"	"	Driven	Occasionally Domestic	unknown	60 ft.[a]	unknown	10" iron	60 ft.	hand	none	-	~460 ft.	F	Qal
26	unknown[d]	Mt. Pleasant	Drilled	Domestic	~1973	84 ft.[d]	unknown	6" steel	unknown	unknown	unknown	-	~790 ft.	U	Silurian bedrock
27	W. Terrell Dickey	Corn Creek	Drilled	Domestic								-	~450 ft.	F	Qal
28	unknown	Corn Creek	Dug	Domestic	unknown	unknown	unknown	unknown	unknown	none	none	-	440 ft	F	Qal

[a] Reported by owner/tenant

[b] Water sample taken

[c] Measured by D & M

[d] Reported by driller; owner claims only a cistern exists on property

F - Flood plain
H - Hillside
U - Upland
V - Valley

5.3.3 Water Use

Ohio River

Within 20 miles in either direction from the proposed plant site (River Mile 572), there are seven existing, proposed, or potential industrial and municipal users on the Ohio River. These are indicated in the following table.

Industrial and Municipal Water Users on the Ohio River
Within 20 Miles of the Proposed Trimble County
Generating Plant Site

River Mile	Water User	State	Comments
555.0	American Electric Power Company	Kentucky	Potential Site
558.5	Madison Municipal	Indiana	
558.5	Madison State Hospital (Municipal)	Indiana	
558.5	Jefferson Proving Grounds, Madison	Indiana	
559.0	Hanover Municipal	Indiana	
560.0	Indiana-Kentucky Electric Company	Indiana	
570.0	Public Service Indiana	Indiana	Proposed Site
582.1	Oldham County Water District No. 1 Municipal Intake	Kentucky	

There are no known Ohio River water users within the immediate vicinity of the site, other than the proposed Marble Hill Nuclear Plant (River Mile 570). The nearest water user below the site is 10 miles downstream.

Ground Water

Plant Site and Ravines

Ground water is used for domestic and farm supplies all along the flood plain of the Ohio River. These small, private wells are usually either drilled or driven into the sand and gravel aquifer, and the yield is generally limited by the design capacity of the well and pump installation. All of the private wells within the boundary of the project site have been abandoned, and no private ground water source exists in close proximity to the project site.

Two municipal well fields are located in the sand and gravel aquifer downstream from the plant site. The nearest well field (about 1 mile below the plant site) belongs to Trimble County Water District No. 1 (Figure 5.3.2-2, location 1; Table 5.3.2-7). Two wells, 68 and 71 feet deep, supply the city of Bedford and were both installed near Wises Landing in October 1957. The average distribution in 1967 and 1968 from one of the two wells was 41,000 gallons per day. Both wells are located about 0.5 mile from the southern boundary of the site and about 1 mile from the proposed plant location.

Henry County Water District No. 2, which serves the communities of Campbellsburg and New Castle, operates three wells located near the mouth of Middle Creek, about 3 miles from the southern border of the plant site. The wells range in depth from 99 to 105 feet and were installed in December 1967. The average distribution in 1968, for two of the three wells, was 570,000 gallons per day for public use and 30,000 gallons per day for industrial use.

The average water used for the areas served by the seven municipal pumping centers (discussed in Section 5.3.1 and identified in Table 5.3.1-5) varies from 1.7 million gallons per day in Madison, Indiana, to 0.12 million gallons per day in Bedford, Kentucky. The largest population served by a water distribution system within 10 miles of the plant site is about 11,600 persons. Bedford and Milton serve the smallest populations, about 450 people each. Although the demand for water is expected to increase as a result of increasing population and higher per capita water use, the existing capacity is greater than the average water use at all seven pumping centers. New facilities should not be needed in this area within the immediate future.

No industrial water well installations exist on the Kentucky side of the Ohio River flood plain within 5 miles of the proposed plant site.

Private wells in the vicinity of the proposed project area were inventoried on March 24-26, 1976. The water well inventory revealed the existence of 22 drilled wells, 4 dug wells, 35 cisterns, and 2 springs. The area of the study and distribution of the wells are shown on Figure 5.3.2-2. The construction features and physical statistics for the private wells are shown on Table 5.3.2-7.

In general, there is a predominance of drilled wells found on the flood plain level from Barebone Creek to Corn Creek as opposed to cisterns or other methods of water catchment. As shown on Table 5.3.3-1, nine drilled wells were identified in the community of Wises Landing and six in the Corn Creek area. Occurring at approximate elevations between 440 to 475 feet MSL, they range in depth from 60 to 106 feet and average approximately 75 feet. Most have 6-inch or 8-inch diameter steel casing; only the municipal wells and a privately owned well have screens below the casing. The principal aquifer unit, a relatively thick (greater than 70 feet) layer of alluvial silt and fine-grained sand in the upper part, and medium- to coarse-grained sand with lenses of gravel in the lower part, yields an average of 100-500 gallons per day along the flood plain terrace. The primary use is as a domestic supply. A few residents reported

TABLE 5.3.3-1

WATER SUPPLY INVENTORY OF PROPOSED TRIMBLE COUNTY GENERATING PLANT BY TOPOGRAPHIC DISTRIBUTION

	Drilled Wells	Dug Wells	Cisterns	Springs
FLOOD PLAIN				
Wises Landing	9		9	
Corn Creek	6	1	2	
VALLEY				
Browning Branch		2	1	
UPLANDS/RIDGES				
Mt. Pleasant	2		3	
Ogden Ridge	4	1	7	1
Wentworth Ridge			5	
"Corn Creek" Ridge	1		5	1
"Upland" Ridge			3	
TOTALS	22	4	35	2

dependence on a water well for livestock, particularly the well at the Pleasant View-Opekasit Farm, which supplies a dairy business in addition to three homes. Although the water is relatively hard, only one privately owned well and the municipal wells produce water which is softened; chlorine is also added to the municipal supply. Nine cisterns were identified in the Wises Landing area and two near Corn Creek. They were, in some cases, supplemented by having water hauled in from the municipal supply (Trimble County Water District) in Bedford; these wells do not directly supply the residents of Wises Landing, as there are no hook-ups or pipelines to this system in the Wises Landing area.

The upland areas at elevations greater than 800 ft. and extending to the west-southwest from Mt. Pleasant are identified on Table 5.3.3-1 as Ogden, Wentworth, "Corn Creek," and "Upland" Ridges. Along the ridges, cisterns outnumber wells 3 to 1, as the Silurian bedrock, composed of fine-grained massive dolomite to dolomitic limestone overlain and underlain by shale units, sustains limited yields to wells. The Laurel Dolomite is the predominant aquifer unit and may produce greater than 100 gallons per day, although most residents contacted reported adequate to less than adequate production from their wells. Because of small yields to wells in the upland, usage is entirely for domestic needs. Farm ponds and cisterns provide the water supply to livestock. Some wells need to be supplemented by cisterns, particularly during dry periods, and may occasionally require water hauling from Bedford. Along the upland areas, 23 cisterns were identified, compared to 7 drilled wells, 1 dug well, and 2 springs. Four of the drilled wells were found along broad-topped Ogden Ridge and the remaining three in the vicinity of Mt. Pleasant. Depths of drilled wells range from 70 to 98 feet, averaging approximately 82 feet. Overburden is thin, approximately 12 to 14 feet in thickness; wells are 6 inches or 8 inches in diameter and cased to rock. Although the water is relatively hard, softeners or demineralizers are not used. The only dug well identified in the area occurs at the break between the upland and the hillside sloping toward the Ohio River. Depth to rock is approximately 25 feet and the well is lined to this depth with limestone rock. Both domestic and livestock needs are served by this well. Springs were found emanating from the hillsides at various points along the upland at the contact between the limestone and shale units. Two domestic supplies were dependent on springs which were flowing from 1/2 to 1 gallons per minute.

Dug wells provided the major source of water to the one inhabited valley within the study area, Browning Branch. Depths of the two dug wells inventoried were 4-1/2 feet and 14 feet and showed static water levels of approximately 14 to 15 feet below ground surface. Both were rock-lined to the bottom. Water is primarily derived from the soil, and, as a result, the dug wells have occasionally needed to be supplemented by water hauled from Bedford during the dry summer and fall months. Only one actively used cistern was inventoried along the valley area.

A total of 7 water samples was taken during the inventory, 4 from the Ohio River flood plain between Wises Landing and Corn Creek, 2 from the Mt. Pleasant-Ogden Ridge upland, and 1 from Browning Branch (see Table 5.3.2-6).

Transmission Line Corridors

Ground water use along the Kentucky transmission line right-of-way is described in the previous section. Ground water use along the preliminary transmission line corridor in Clark County, Indiana is discussed in Section 5.3.1 under "Hydrologic Characteristics (Ground Water): Transmission Line Corridors."

5.3.4 Aquatic Biota

Introduction

As far as can be determined from a thorough search of the literature and available unpublished data, no studies have been made of the aquatic biota in the Ohio River in the immediate vicinity of the Trimble County plant site, of any of the streams in Trimble County, nor of the streams within the preliminary transmission line corridor in Clark County, Indiana. Still, there are references to the biota of the Ohio River drainage in areas upstream and downstream from the plant site that provide information on the relative abundance and distribution of the aquatic plants and animals of the general region.

An aquatic survey of the Ohio River and Corn and Barebone Creeks was conducted by Consultants from the University of Louisville's Water Resources Laboratory from April to December of 1975 to obtain site-specific information about the aquatic biota. In February, March, and April of 1976, they surveyed the streams of Ravines RA and RB and also conducted additional sampling of Corn Creek. The locations of the sampling areas are presented on Figure 5.3.4-1 and described in detail in Appendix P. Appendix Q and Technical Appendix VI contain the tables of survey data.

Ohio River

Plankton and Aquatic Macrophytes

The most complete information on plankton in the Ohio River is that reported by the Ohio River Valley Water Sanitation Commission (1962); 50 genera of phytoplankters were listed in the report. Fifteen of these genera were found essentially throughout the river. Among the zooplankters, 6 protozoans, a sponge, a coelenterate, an endoproct, 18 rotifers, 6 cladocerans, and 2 copepods, along with nauplii, were listed. The most extensive study of phytoplankton is that of Seilheimer (1963), in which 168 species were listed as taken between 1960 and 1962 from the Ohio River at the lower end of the McAlpine Pool, some 30 miles downstream from the plant site. In his study, he also listed 54 species of zooplankton. In a later study, Riley (1969) sampled the entire length of the McAlpine Pool and reported much the same kinds and diversity of species as Seilheimer.

In the aquatic sampling program for the Trimble County Generating Plant project, plankton samples were taken at scheduled periods by pumping 20 liters of water from the water column at each of the nine stations on the three transects. The 20-liter aliquot was filtered through a phytoplankton net (#25 bolting cloth--0.065 mm aperture), and the concentrated sample was treated with Lugol's solution to precipitate the organisms. Subsamples were counted using a Sedgwick-Rafter cell (see Welch, 1948). Phytoplankton quantities per liter were then estimated by calculation.

Tables 1 to 4, Appendix Q, present the relative abundance, density, and diversity of phytoplankton along the three transects of the Ohio River. Table 5, Appendix Q, presents plankton biomass as ash-free dry weight. Asterionella formosa and Melosira spp., along with other diatoms, form the major species in the river. Asterionella is a relatively common limnetic phytoplankter in this area. This species, along with the diatoms, attests to the character of the Ohio River at the plant site and the quality of the water there--medium hard water with a good ionic balance and with some oxygenation in the upper 6 to 8 feet. With the high-level dams now operating and controlling pool levels in the Ohio River, late spring and summer conditions encourage the development of limnetic phytoplankton species.

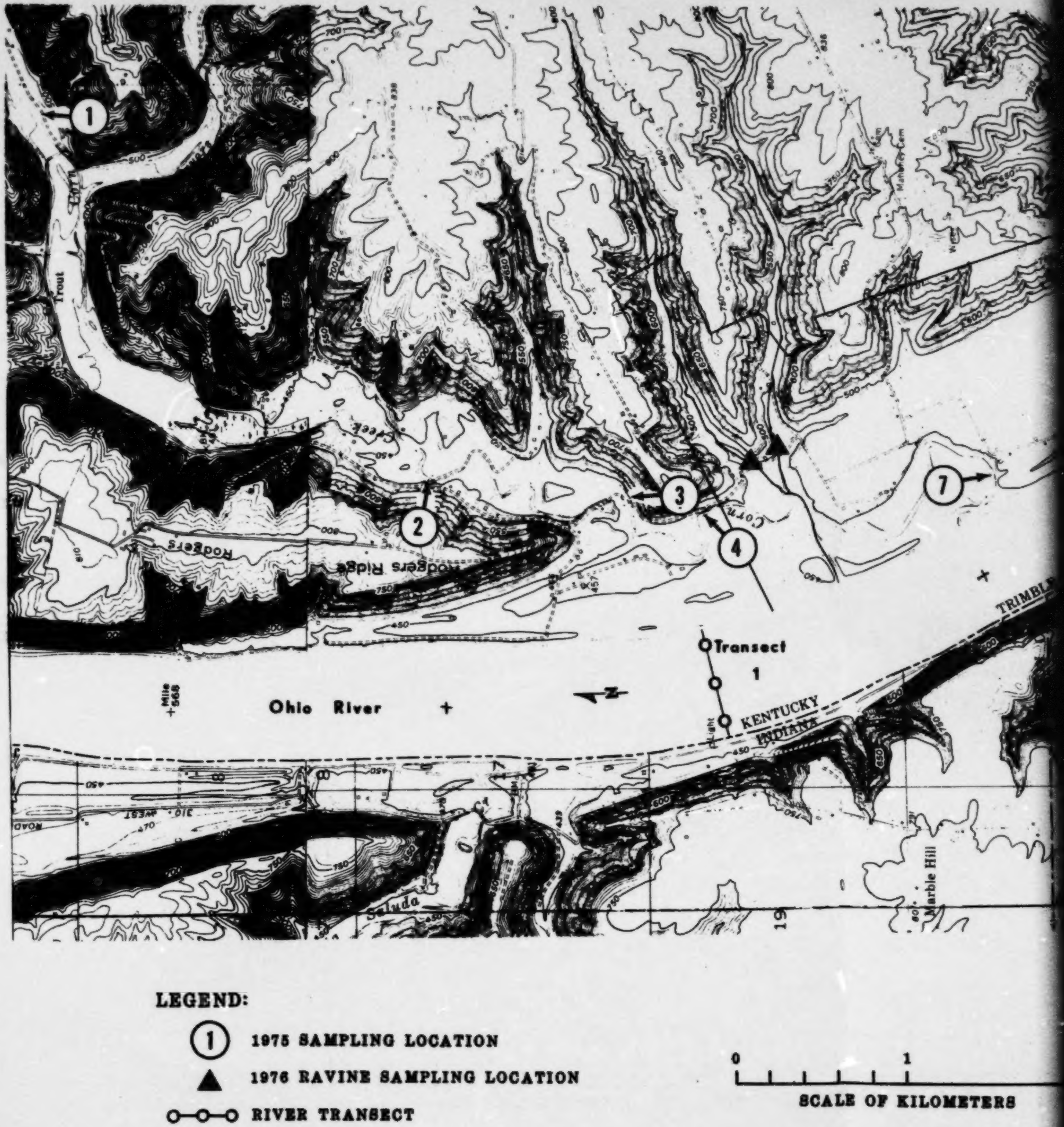
Along the Kentucky side of the Ohio River at the plant site, large beds of Potamogeton pectinatus L. were present during the summer growing season.

Benthos

Perhaps the best information on bottom fauna, in addition to the limited information supplied by the Ohio River Valley Water Sanitation Commission (1962), that may be applicable to the Ohio River near the study area is that reported by Mason et al. (1971) from Cincinnati (River Mile 463) and Louisville (River Mile 600) for a 5-year period (1963-1967). The former site lies within the Markland Pool more than 100 miles upstream from the plant site, whereas the latter lies within the McAlpine Pool about 30 miles downstream from the plant site area. Sampling was done at each site with Petersen and Ekman dredges and with artificial substrate samplers. For the 5-year study, 87 different kinds of organisms were listed, including Diptera (chironomids and culicids), Trichoptera, Plecoptera, Ephemeroptera, Odonata (zygopterans and anisopterans), Coleoptera, Hemiptera, Crustacea (amphipods, isopods, and decapods), Hirudinea, Turbellaria, Nematoda, Mollusca (gastropods and pelecypods), Bryozoa, Coelenterata, and Porifera. Of those, 68 kinds were listed as being taken at Louisville and 54 kinds from Cincinnati (Table 5.3.4-1).

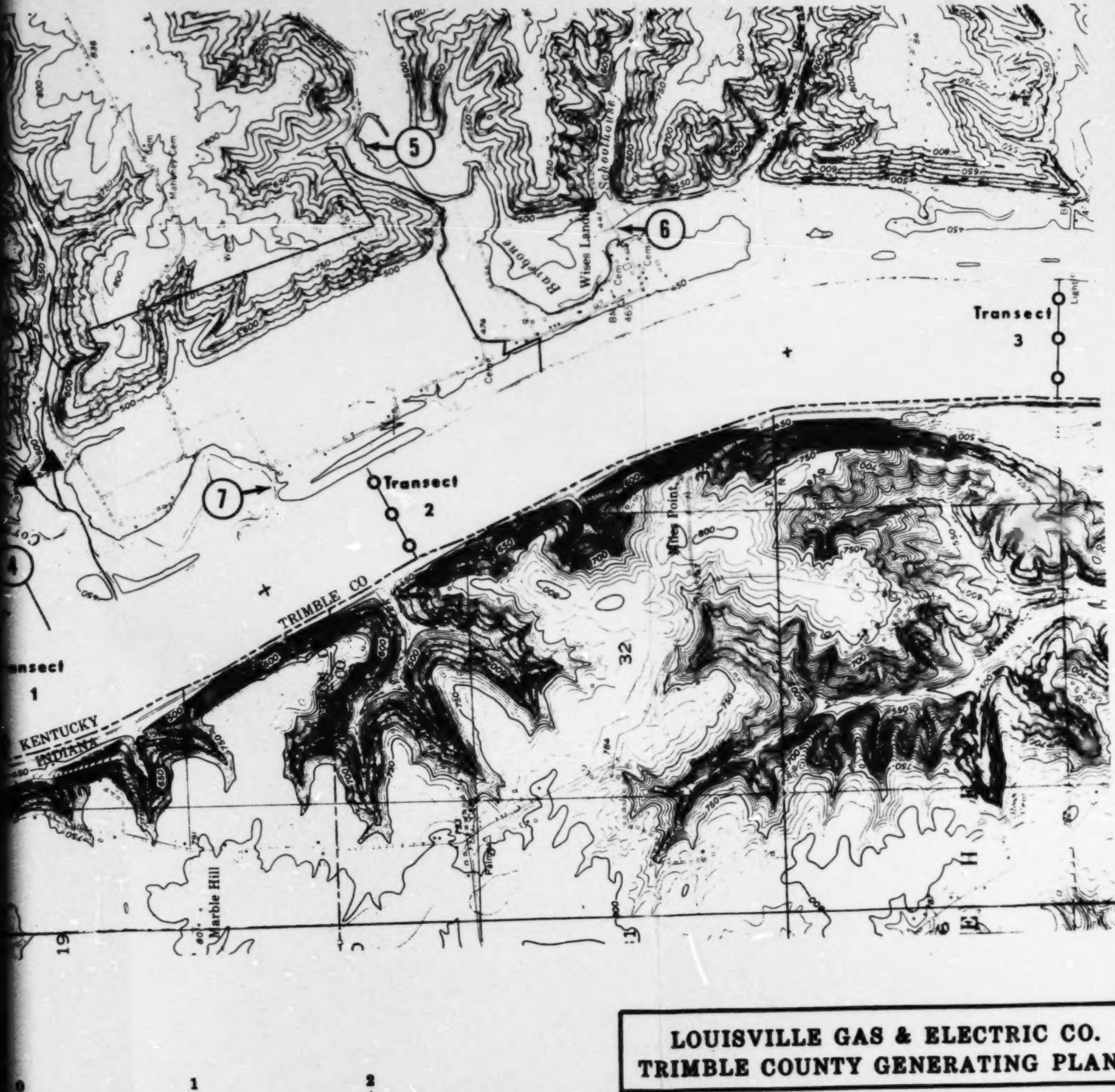
Information from two other studies on special groups of bottom organisms from the McAlpine Pool is available. Bickel (1964) studied the distribution of five snails and two bivalve mollusks in the Ohio River near Louisville. In his study of the bivalve mussel fishery of the Tennessee, Ohio, and Green Rivers in Kentucky, Williams (1969) reported 21 genera and 29 species from the Ohio River, of which 15 genera and 21 species were represented in the collections taken between Ohio River Miles 538 and 648. That area includes nearly the entire McAlpine Pool and the upper 40 miles of the Cannelton Pool.

For the Trimble County Generating Plant site study, organisms were collected from the Ohio River with a Ponar sampler and with the use of SCUBA gear. Tables 6 through 12, Appendix Q, summarize the fauna taken in these collections for May, July, August, September, October, and November 1975. Oligochaete worms, chironomid (midge) larvae (Diptera), and Asian clams



1
2
3
4
7
Trout
Rodgers
Rodgers Ridge
Creek
Corn
Transect
1
Mile 568
Ohio River
KENTUCKY
INDIANA
TRIMBLE
Saluda
Marble Hill
LEGEND:
1975 SAMPLING LOCATION
1976 RAVINE SAMPLING LOCATION
RIVER TRANSECT
0
1
SCALE OF KILOMETERS

Source: University of
Louisville, 1975a and 1976a


5
6
7
4
Transect 1
Transect 2
Transect 3
Schoolhouse
Wises Landing
Barebone
Cem
TRIMBLE CO
KENTUCKY
INDIANA
32
Marble Hill
19
0
1
2
SCALE OF KILOMETERS

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

CREEK SAMPLING STATIONS
AND OHIO RIVER TRANSECTS
FOR AQUATIC STUDIES

FIGURE 5.3.4-1

TABLE 5.3.4-1

NUMBERS OF DIFFERENT KINDS OF BOTTOM ORGANISMS REPORTED BY MASON ET AL. (1971) FROM CINCINNATI AND LOUISVILLE

	Louisville	Cincinnati	Total
Diptera			
Chironomidae	23	26	32
Culicidae	1	1	1
Trichoptera	6	4	8
Plecoptera	2	1	2
Ephemeroptera	5	3	5
Odonata			
Zygoptera	4	2	5
Anisoptera	1	2	2
Coleoptera	0	1	1
Hemiptera	1	0	1
Crustacea			
Amphipoda	2	2	3
Isopoda	1	0	1
Decapoda	1	1	1
Hirudinea	2	0	2
Turbellaria	x	x	x
Nematoda	x	x	x
Mollusca			
Gastropoda	6	3	7
Pelecypoda	6	2	6
Bryozoa	5	2	6
Coelenterata	2	3	3
Porifera	0	1	1
TOTAL	68	54	87

x = Present, but not counted.

Source: University of Louisville, 1975a

are the predominant forms of benthos in this region of the river. Notable in these samples were representatives of Trichoptera and Ephemeroptera. In this latter group, specimens of *Anepeorus simplex* and *Pseudiron* were obtained. Both are considered rare mayflies, for they are seldom collected and little is known about their life history or ecology (Burks, 1953). *Anepeorus simplex* is purported to be carnivorous and derived from *Heptagenia*-like ancestors (Edmunds, 1972). Adults of *A. simplex* are unknown.

Quantitatively, Ohio River benthos are fewer in number and less in diversity than the benthic communities in Corn and Barebone Creeks (see discussion under "Corn and Barebone Creeks and the Oxbow"), a condition which is probably a function of collecting methods rather than representative of actual conditions. This is reflected in the computed diversity, which is rather low. The diversity index exceeded 2.5 (2.82) only once, averaging 0.5 to 0.8 during the sampling period.

The presence of a variety of mussels on the Indiana side of the river is a reflection of the consistency of the bottom strata. The Indiana side is cobbles, gravel, and rock; the Kentucky side is sand. Seven genera, nine species were collected in this study. Williams (1969) listed seven commercially valuable mussels from this area of the river. Four commercially valuable species were obtained during the Trimble County plant site study. Dredging and pollution are the major factors in reducing the number of mussels in the Ohio. It must be remembered that the larval mussel (glochidium) is an obligate parasite upon a fish. Often glochidia are host specific and must attach to a specific fish species for dispersal and completion of the life cycle. Because of the reduction of fishes in the Ohio River, the mussels suffer as well.

Fishes

In studies of the fish population of the Ohio River in 1957 to 1959 by the University of Louisville (Ohio River Valley Water Sanitation Commission, 1962) and by the Environmental Protection Agency in 1968 to 1970 (University of Louisville, 1975b), a total of 76 species of fishes was listed as being taken either from lock chambers at Markland Locks and Dam (River Mile 535) and at McAlpine Locks and Dam (River Mile 607) or from the mouths of streams between those stations (Appendix R). In its study, the University of Louisville made five collections at Markland Locks and Dam (or Lock and Dam No. 39, which was replaced by Markland Locks and Dam) and 29 collections from the small lock chamber at McAlpine Locks and Dam. The Environmental Protection Agency made three collections from Markland Locks and Dam and three from McAlpine Locks and Dam. In addition, the University of Louisville made 28 collections from stream mouths and by seining appropriate sites along the shores of the Ohio River. Included were three samples from the lock chamber at Kentucky River Lock and Dam No. 1. In total, these collections represent 68 samples of the fish life in the Ohio River over a period of 14 years. At the moment, there is little reason to believe that there have been any changes in the species composition or relative abundance of the various kinds of fishes since those samples were taken.

The reason for the marked differences in the number of species in the collections by the different agencies is that many different kinds of small fishes, such as minnows and darters, were taken from the stream mouths and by seining by personnel of the University of Louisville.

During the sampling program for the Trimble County Generating Plant project (July through October, 1975), fishes were collected by dip nets, gill nets, hand seines, and electroshocking apparatus. In the Ohio River, 1-inch and 3-inch mesh gill nets of 150-foot length were set for 24-hour periods.

The majority of fishes collected in the survey were rough or forage fish (Table 5.3.4-2 and Technical Appendix VI). The rough and forage species were represented by a few individuals each or only a single specimen. The most abundant fish from the Ohio River was the emerald shiner. Additional collecting effort would increase the number of species in the list of Ohio River fishes, as some of the tributary species which were collected doubtless would occur in the Ohio River as well.

On October 23, 31 sauger, most of them yearlings, were caught near the mouth of Corn Creek. This unusual catch of a relatively uncommon game fish at the mouth of the creek may indicate that creek mouths serve as points of concentration for sauger in the fall and perhaps at other seasons as well.

The Ohio River in the vicinity of the plant site was surveyed in August 1975 for potential spawning habitat. The Ohio River in the vicinity of the plant site has four general substrate types: a loose sand-silt mixture, compacted sand, graded gravels, and a gravel-rubble mixture. The Kentucky side of the riverbed at the plant site slopes gradually toward mid-channel; on the Indiana side, the slope is much steeper. Currents on the Kentucky side are much slower than on the Indiana side, because the main channel in this area is close to the Indiana side of the river.

The riverbed on the Kentucky side from River Mile 570 above the mouth of Corn Creek to River Mile 573 at the mouth of Barebone Creek is made up mostly of soft sand-silt mixtures and compacted sand, with occasional sections of graded gravel and sand-gravel mixtures in water over 10 feet deep. On the Indiana side, there are more extensive areas of gravel, rubble, and gravel-sand mixtures. These substrates are kept relatively silt-free by the swifter main channel currents. Because the area along the site is a long, straight stretch of the river, few snags or other obstructions or debris are present on either side.

The spawning habits of the major fish species present in this area of the river can be divided generally into the following three groups:

1. Broadcast spawners over gravel and rock substrates
2. Broadcast spawners that spawn over soft substrates or flooded vegetation

TABLE 5.3.4-2

FISHES TAKEN FROM THE OHIO RIVER AND CORN AND BAREBONE CREEKS, JULY-OCTOBER, 1975, TRIMBLE COUNTY GENERATING PLANT SITE

Common Name	Ohio River	Corn Creek	Barebone Creek	Total
American eel	1	-	-	1
Black crappie	2	-	-	2
Bluegill	77	53	2	132
Bluntnose minnow	1	211	7	219
Carp	15	-	-	15
Carpsucker	1	-	-	1
Channel catfish	4	-	-	4
Common shiner	-	413	159	572
Creek chub	-	68	15	83
Emerald shiner	105	497	-	602
Fantail darter	-	15	2	17
Freshwater drum	5	-	-	5
Gizzard shad	18	8	2	28
Golden redhorse	2	11	-	13
Goldeye	2	-	-	2
Green sunfish	1	-	1	2
Johnny darter	-	12	-	12
Largemouth bass	7	-	-	7
Logperch	-	1	-	1
Longear sunfish	1	5	3	9
Longnose gar	27	-	-	27
Northern hog sucker	-	3	-	3
Popeye shiner	-	15	-	15
Rainbow darter	-	30	1	31
Rock bass	4	-	-	4
Rosefin shiner	-	29	109	138
Sauger	33	-	-	33
Silverjaw minnow	-	40	-	40
Skipjack herring	23	2	-	25
Smallmouth bass	12	21	-	33
Smallmouth buffalo	1	-	-	1
Spotted bass	2	-	-	2
Spotted sucker	-	1	-	1
Stoneroller	2	80	8	90
Warmouth	1	2	-	3
White bass	16	-	-	16
White crappie	-	2	-	2
White sucker	-	4	-	4
Total Number of Fish	363	1,523	309	2,195
Total Number of Species	25	21	11	36

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*Endangered or threatened in Indiana (State of Indiana, no date a).

Source: University of Louisville, 1975a.

3. Nest or cavity spawners--usually on or in firm substrate

The most desirable game or commercial fish fall into either group 1 (white bass and sauger) or group 3 (channel catfish, crappie, sunfishes, and largemouth, smallmouth, and spotted basses). The less desirable species (gar, carp, carpsucker, buffalo, shad, and skipjack herring) are contained in group 2--broadcast spawners over soft substrates or flooded vegetation--the type of habitat most common on the Kentucky side of the river at the plant site. The nearest gravel and rubble substrate on the Kentucky side of the river is located at River Mile 575, about 2.5 miles below the plant site.

No rare or endangered species of fish was encountered during the present survey in the Ohio River in the region of the plant site.

Corn and Barebone Creeks and Oxbow

Benthos

Corn Creek, Barebone Creek, and the oxbow were also sampled for benthic organisms by means of Ponar and Ekman dredges. The results of the survey are presented in Tables 13 through 25, Appendix Q.

Thirty-seven taxa were collected from the streams and oxbow. The streams support a rather suprisingly diverse fauna, considering their intermittent character and the man-induced disruptions that they have suffered.

Six genera of Ephemeroptera were collected; all are common to small streams in this part of Kentucky. Two genera of Plecoptera were collected as well. Both genera are common to the north-central region of the state (White, 1974).

Members of the Diptera or true flies make up the majority of the streams' and oxbow's benthic biota. As is often the case, the Chironomidae (non-biting midges) were present in the greatest numbers. Larvae of species belonging to the Orthocladiinae--primarily *Orthocladius*, *Psectrocladius*, and *Cricotopus*--were found in all samples from the two streams. The presence in the streams and the oxbow of larvae and pupae belonging to the Empididae is of great interest because they are rather uncommon in most stream samples. In April and May, two species of *Wiedemannia* were collected. In July, specimens of *Hemerodromia empiformis* (?) were collected. Little is known concerning the life history of these species, whose larvae are purported to be predaceous (Usinger, 1956).

The caddisflies or Trichoptera were collected at five stations on Corn Creek and two stations on Barebone Creek. Six genera were present in the collections. All are common to this area of Kentucky (Resh, 1975). Larvae of the genus *Rhyacophila* are predaceous; all other larvae in the samples are collectors or detritus feeders or browsers upon attached algae or periphyton.

Beetles (Coleoptera) were represented by several families, particularly the Elmidae and Psephenidae. Psephenus sp., the water penny, is a very common beetle larva in Kentucky streams. This larva seems very tolerant to siltation and some forms of pollution. Stenelmis, belonging to the Elmidae family, is a genus with some 15 species. These species exhibit wide variations in tolerance to turbidity, siltation, and industrial pollutants. Several species are rather tolerant to chlorinity (Sinclair, 1964).

Species diversity indices for the samples compare favorably with indices calculated for samples from other streams in Kentucky (e.g., the Salt River, Paint Creek, Blaine Creek). The index values (ranging from 0.5 to 3.21) probably reflect inadequate sampling techniques rather than establishing a community diversity value (Goodman, 1975). In any case, the stream fauna appear to be diversified enough to represent streams that receive a minimal amount of point source effluents, with non-point source effluents from agricultural lands contributing to the restriction of the fauna.

Both creeks are either subject to frequent channel modification or to the use of the stream bed as a source of gravel and stone. The latter is particularly true of Barebone Creek. These activities have an effect analogous to that of point source effluents. They extirpate the fauna in the immediate area of the dredging and reduce the fauna downstream from the excavation area, just as a domestic or industrial effluent source would affect the fauna. Presumably, the stream fauna recover within a year or two, for many of the insect species are univoltine (one generation per year).

Because the range and distribution of the invertebrate species making up stream benthos are so poorly known, rare and endangered benthic species cannot be identified. Some seemingly rare species of Empididae (Diptera) have been collected. Two species of predaceous mayflies (Ephemeroptera) were collected; any entomologist will term these mayflies "rare" because they are seldom collected. In general, the Corn and Barebone Creek drainages contain no species whose existence is threatened.

Fishes

Corn and Barebone Creeks were sampled by seining, netting, and electroshocking from April through October, 1975. Station 7 (see Appendix P) on the oxbow was seined once in August 1975. Sampling during April through June was not representative because of the inaccessibility of some stations (high water) or, in the case of Station 1, because man-made disruptions altered the station's characteristics. The most abundant species in Corn Creek was the emerald shiner (497), followed by the common shiner (413). The most abundant species in Barebone Creek was the common shiner (159), followed by the rosefin shiner (109). Table 5.3.4-2 provides a summary of the species and number of fishes collected from the two creeks from July through October, when sampling was performed in a consistent manner. Technical Appendix VI contains a monthly breakdown of species and numbers for these 4 months.

Species collected during the April through June sampling period that are not listed in Table 5.3.4-2 are the following:

1. The spotfin shiner and greenside darter, which were collected in April at the original Station 1 on Corn Creek (this station was later relocated)

2. The blacknose dace and black bullhead, collected in May from Corn Creek

3. The orangethroat darter, collected in May from both Corn and Barebone Creeks

The seining effort in the oxbow in August 1975 yielded no fishes. However, in September 1976, several large fish, presumed to be carp, were observed in one of the two large (but shallow) pools remaining in the oxbow area. Several skeletons of fish, believed to be of carp and catfish, were observed near the edge of the pool. These skeletons were of fish estimated to have been possibly 2 to 4 pounds in weight.

On August 11 and 28, 1975, potential spawning areas in Corn and Barebone Creeks were surveyed on foot and by boat.

Both creeks are relatively high-gradient streams, with rubble, gravel, and coarse sand substrate in their upper reaches. During the August 28 survey, longear sunfish and rosefin shiners were observed spawning in shallow waters at the edges of pools with rubble and gravel bottoms. The large number of young-of-the-year smallmouth bass seined from both creeks during the summer indicates that these streams are important spawning areas for smallmouth bass, which ascend the streams from the Ohio River in April and May of each year. Other river fishes that enter these streams to spawn would include golden redhorse, white suckers, and spotted bass. Above Station 4, Corn Creek offers approximately 6 miles of excellent spawning habitat for these river species, as well as for the resident minnow and sunfish populations. Barebone Creek, above Station 6, offers an additional 3.5 miles of excellent spawning habitat.

Ravines RA and RB

The beds of North and South Creeks are composed of gravel and rubble from the ravine faces. This rock debris provides shelter for aquatic organisms and helps in concentrating the biota as pooling takes place during low flow (dry) periods.

Sampling locations for the survey of the ravines' streams are shown on Figure 5.3.4-1. The invertebrate organisms collected for both North and South Creeks are listed in Table 5.3.4-3. Fish species, collected from pools in South Creek, are listed in Table 5.3.4-4. Both streams seem to support a diminished fauna. Crustaceans (Lirceus, Gammarus, and Asellus) are the predominant inhabitants. These, along with a variety of aquatic insect larvae, are common in small, intermittent streams that form pools. Some are found in larger streams as well. Examples are

TABLE 5.3.4-3

INVERTEBRATES TAKEN FROM NORTH CREEK (RA) AND SOUTH CREEK (RB), TRIMBLE COUNTY GENERATING PLANT SITE, 1976

Species		North Creek	South Creek
Platyhelminthes	Turbellaria	M, A[a]	F, A
Annelida	Oligochaeta	F, M, A	F, M, A
Crustacea	*Lirceus* sp.	F, M, A	F, M, A
	Gammarus sp.	F, A	F, M
	Asellus sp.		M
Ephemeroptera	*Stenonema* sp.	F	A
	Caenis sp.	F	M
	Baetinae	M	F, M
	Baetis sp.	A	M
	Pseudocloeon sp.		M
	Paraleptophlebia sp.		M, A
Plecoptera	*Isogenus* sp.	F, A	F, M, A
	Nemoura sp.	M, A	F, M, A
Trichoptera	*Chimarra obscura*	F, A	F, M, A
	Neophylax sp.	F, M, A	
	Hydroptilidae	A	
	Rhyacophila	A	
Diptera	Chironomidae	F, M, A	F, M, A
	Tipula abdominalis	F, M, A	A
	Empididae	M, A	F
	Tabanidae	M	
	Simuliidae	A	
Coleoptera	*Psephenus herricki*	F	F, M, A
	Elmini	F, A	M, A
	Hydrophilidae (*Berosus*?)	M	
Other	Collembola	F	
	Sphaeridae	A	

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[a] F = February 4, 1976
M = March 9, 1976
A = April 6, 1976

Source: University of Louisville, 1976a

TABLE 5.3.4-4

FISHES TAKEN FROM POOLS IN RAVINE RB,
TRIMBLE COUNTY GENERATING PLANT SITE
NOVEMBER 12, 1975

Common Name	Scientific Name	Number
Blacknose dace	Rhinichthys atratulus	6
Creek chub	Semotilus atromaculatus	1
Fantail darter	Etheostoma flabellare	1
Stoneroller	Compostoma anomalum	2
TOTAL		10

Source: University of Louisville, 1976a

Caenis sp., Isogenus sp., Tipula abdominalis, and Tabanus sp. The lack of stream faunal diversity further attests to the limits placed on the faunal composition by the streams' low and intermittent flow characteristics.

North and South Creeks have a slightly more mineralized water than Corn Creek. They harbor that portion of the stream fauna of the area that is more adaptable to low or intermittent flow conditions. The creeks of the ravines serve as "refugia" for some stream fauna species and offer a source of individuals to repopulate the lower reaches of Corn Creek if necessary.

Transmission Line Corridors

The Kentucky transmission line right-of-way crosses Barebone Creek; the biota of this stream have been discussed in a previous subsection.

There are no available data on the biota of the streams within the preliminary transmission line corridor in Clark County, Indiana. Because these streams also drain into the Ohio, it is likely that their biota are similar to those found within Corn and Barebone Creeks. A list of fishes that might be present within the Indiana streams is presented in Appendix S.

5.4 DEMOGRAPHY

The following demographic discussion is devoted primarily to Trimble County, as Clark County (the location of the preliminary transmission line corridor) will not experience a significant population change as a result of the project.

5.4.1 Existing Population and Density

Trimble County Historical Population Trends

Trimble County became Kentucky's 86th county in 1836. By 1840, the county population was 4,480 (Commonwealth of Kentucky, 1975a). The county grew from 1840 to 1900, thereafter declining to a 1970 population of 5,349, a net increase of only 869 people over the 130-year time span. According to the Kentucky Department of Commerce, the population of Trimble County was projected at 5,500 for 1974, indicating a relatively stable population base (Commonwealth of Kentucky, 1975a).

From 1950 to 1960 the net migration of people from Trimble County was only 46, yielding a percent change of -0.9 percent (U.S. Department of Commerce, 1950, 1960, 1970). Between 1960 and 1970, 247 people moved into Trimble County, an increase of 4.8 percent. This compares to a 6 percent increase in population over the same time period for the entire state of Kentucky.

Clark County Historical Population Trends

Clark County, Indiana was organized in 1801. The county had a total land area of 384 square miles. In 1960, the total county population was 62,800 (U.S. Department of Commerce, 1960). By 1970, the population had reached 75,900 (U.S. Department of Commerce, 1970) and by 1975, was at 81,700 (Indiana University, 1976). From 1970 to 1974, the net migration for the county was +2,300.

The population of New Washington, Indiana, which is an unincorporated town about 2.6 miles east of the proposed terminus point of the preliminary transmission line corridor, is approximately 500.

Trimble County Population Composition

Of the total 5,349 people in Trimble County in 1970, 1,849 were under 18 years of age, 2,881 were between 18 and 65, and 619 were over 65 years of age, for a median age of 28.1. This compares to a median age of 27.5 for the state, indicating a slightly older population for Trimble County. In 1970, a total of 2,664 males and 2,705 females lived in the county, of which only 3 were non-white. The percentage of males and females in the county is identical to the state composition. However, at the state level, the non-white population is 7.4 percent. Median school years completed indicate that Trimble County is only slightly below the state average of 9.9 (U.S. Department of Commerce, 1973).

Demographic data for Trimble County, and data for five surrounding counties to which major numbers of Trimble County residents commute, are summarized in Table 5.4.1-1.

Clark County Population Composition

The age and male-female distribution of the population for Clark County, Indiana is shown in Table 5.4.1-2.

5.4.2 Future Population and Density

Water Resources Projections

Trimble County is located within Water Resources Subarea 511, Louisville-Salt, which centers in Louisville, Kentucky. The population of this subarea totaled 1,070,550 in 1970, a figure that is projected to increase to 1,920,000 by 2020 (U.S. Water Resources Council, 1974). The non-SMSA (Standard Metropolitan Statistical Area) portion of this population was 242,903 in 1970, of which Trimble County was a part. By 2020, the non-SMSA population is projected to reach 351,400, an increase of 45 percent over the 50-year time period. This compares to a 79 percent increase in total population for the subarea, including both SMSA and non-SMSA population. Thus, the majority of the increase in population within the Louisville-Salt Water Resources Subarea is accounted for by an increase in the SMSA population base. From 1970 to 2020, the SMSA population is projected to increase 90 percent (U.S. Water Resources Council, 1974). The population in Kentucky is projected to increase from 3,224,000 in 1970 to 4,666,200 in 2020, a 45 percent increase. Total U.S. population is projected to increase 46 percent. The non-SMSA portion of the U.S. population, recorded by Water Resource Subareas, is projected to increase 20 percent.

Trimble County

Assuming an average annual growth rate of 0.9 percent, the population density within Trimble County by 2020 should be 81 persons per square mile. This estimate is based on the growth rate of the non-SMSA population within the Water Resources Subarea 511, Louisville-Salt.

The Federal-State Cooperative Program for Population Estimates shows a near term net decrease in the county population (U.S. Department of Commerce, 1974). It is anticipated that an improved economic climate for the county would reverse this trend.

Clark County, Indiana

The population of Clark County, which is also part of the Water Resources Subarea 511, Louisville-Salt, is expected to increase by 6,800 individuals between 1975 and 1980 and by 7,400 individuals between 1980 and 1985. The following is a breakdown of projected population growth

TABLE 5.4.1-1

DEMOGRAPHIC SUMMARY OF THE TRIMBLE COUNTY GENERATING PLANT SITE REGION, KENTUCKY, AND INDIANA

	Trimble	Carroll	Henry	Jeff-Kent.	Jeff-Ind.	Oldham	Kentucky	Indiana
Pop-1970	5,349	8,529	10,910	695,055	26,966	14,687	3,218,706	5,193,669
Density per sq mi.	37	66	38	1,353	74	80	81	155
Net Migration (1960-70)	247	162	-964	10,891	675	115	-153,329	15,581
Median Age (1970)	28.1	29.7	34.4	27.4	28.2	26.9	27.5	27.3
White (1970)	5,325	8,310	10,108	598,056	26,560	13,359	2,983,375	4,825,434
Black (1970)	3	219	756	95,393	406	1,316	230,363	356,379

Source: U.S. Department of Commerce, 1970

TABLE 5.4.1-2

POPULATION BY SEX AND AGE, 1970, 1975
CLARK COUNTY, INDIANA

Age	1970		1975	
	Male	Female	Male	Female
0-4	3,540	3,300	3,490	3,330
5-9	4,140	3,960	3,750	3,500
10-14	4,170	4,040	4,290	4,140
15-19	3,430	3,660	4,220	4,060
20-24	2,770	3,400	3,210	3,580
25-29	2,790	2,860	2,460	3,370
30-34	2,220	2,350	3,140	3,150
35-39	2,100	2,190	2,590	2,500
40-44	2,240	2,420	2,130	2,180
45-49	2,260	2,380	2,180	2,390
50-54	1,930	2,010	2,140	2,310
55-59	1,650	1,600	1,830	1,960
60-64	1,250	1,400	1,470	1,510
65-69	960	1,130	1,090	1,320
70-74	640	920	740	1,010
75 +	820	1,380	940	1,740
Total	36,900	39,000	39,600	42,100

Source: Indiana University, 1976

in Clark County through 2000, by which time the county should have a population density of 310 persons per square mile (Indiana University, 1976):

Year	Projected Population
1980	88,500
1985	95,900
1990	103,600
1995	111,400
2000	119,100

5.5 ECONOMY

5.5.1 Trimble County Existing Economy

Family Income

Median family income in Trimble County in 1969 was $6,596. Per capita income in 1969 was $2,073; this increased to $3,339 by 1973, an increase of 59.8 percent. Although state per capita income was higher than in Trimble County in 1969 ($2,894) and 1973 ($4,050), the percent change (39.9) was smaller.

Personal Income

Personal income for Trimble County, the Applicant's service area, and Kentucky is presented in Table 5.5.1-1. This table indicates the importance of farming to Trimble County and its relative unimportance to total personal income for the service area and the state.

Unemployment and Labor Force

The rate of unemployment in Trimble County was only 2.5 percent in 1974 (U.S. Department of Commerce, 1974). This compares to an unemployment rate of 4.5 percent for the state. The total labor force in the county in 1974 was 2,510, of which 1,870 were male and 640 female. None of the labor force for Trimble County in 1974 was black. In the labor force at the state level, males constituted 63.7 percent of the labor force and females 36.3 percent. In addition, nonwhites made up 6.9 percent of the labor force at the state level.

Local Government

The Trimble County budget for 1973-74 (Commonwealth of Kentucky, 1975a) was:

General Fund	$ 69,386
Road Fund	$ 69,373
TOTAL	$138,759

Budgets for 1973 for two Trimble County cities, Bedford and Milton, were as follows (Commonwealth of Kentucky, 1974a):

Bedford - General Fund - $10,000 (estimated)

Milton - General Fund - $ 7,867
Water Fund - $27,335

TABLE 5.5.1-1

1973 PERSONAL INCOME BY SOURCE (PERCENT), TRIMBLE COUNTY, APPLICANT"S SERVICE AREA, AND KENTUCKY

	Trimble County	LG&E Service Area	Kentucky
Farming	58	2	6
Manufacturing	**	34	27
Mining	0	*	3
Contract Construction	6	7	6
Trade	5	16	14
Finance, Insurance and Real Estate	6	5	3
Transportation, Communication and Public Utilities	1	8	7
Services	**	12	12
Government	14	17	17

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* Less than 1 percent.

** Withheld to avoid disclosure of confidential information.

Source: Commonwealth of Kentucky, 1975a

The assessed property value of the two cities and the county for 1973 is tabulated below (Commonwealth of Kentucky, 1973c):

	Bedford	Milton	Trimble County
Real Estate and Tangibles		$2,325,075	
Real Estate	$2,343,038		$33,557,145
Tangibles	488,988		5,367,890
Public Service	260,000 (estimated)	183,254	5,386,887

Sales and Income Taxes

Total sales and use tax receipts for Trimble County were $108,976 in 1973. This compares to $301,658,780 for the state (Commonwealth of Kentucky, 1973c). Total Kentucky individual income tax in 1973 was $231,097 for Trimble County, compared to $195,710,178 for the state. Bank deposits in the county totaled $15,270,000, compared to $8,245,698,000 for the state.

Housing Information

The housing data from the 1970 Census Report (U.S. Department of Commerce, 1973) show a larger percentage of older units in Trimble County (houses built prior to 1950) than the state. Approximately 64 percent of the units in Trimble County were constructed prior to 1950, compared to the state average of 56 percent. There were 1,789 year-round housing units in Trimble County in 1970, a figure that indicates an increase of 16 percent over 1960. Of the total of 1,789 year-round units in Trimble County, 1,696 were occupied. Approximately 73 percent of the housing units that were occupied were owner occupied. The median value of houses in Trimble County was $12,021 in 1970, compared to the state average of $12,830. The county also had 30 percent of its occupied housing units lacking some or all plumbing.

Local Community Services

Transportation

Rail service for the county and the two cities is available in Carrollton, 13 miles northeast of Bedford. The railroad is the Carrollton Railroad (a subsidiary of the L&N Railroad) and is the nearest railroad.

Trucking services are available to the county by Lee Way Motor Express, Incorporated, of Oklahoma City, Oklahoma; O.K. Trucking Service of Cincinnati, Ohio; and O'Naw Transportation Company of Carrollton, Kentucky.

Commercial air service is available at Standiford Field in Louisville, approximately 41 miles from Bedford.

Bus service for Bedford and Milton is provided by Greyhound Bus Lines.

Electrical Power, Fuel, Water, and Waste Treatment

Electric services for the county are provided by the Shelby Rural Electric Cooperative Corporation. Both Bedford and Milton are serviced by the Kentucky Utilities Company.

Natural gas is distributed to Bedford by the Louisville Gas and Electric Company; Milton is serviced by the Ohio River Gas Company.

Propane, butane, and distillate fuel oil are available from a variety of local suppliers in Carrollton. Arrangements must be made with refineries, however, for residual fuel oil.

Water is supplied to Bedford from wells on the Ohio River at Wises Landing (see Section 5.5.5). Bedford's waste treatment plant has a capacity of approximately 245,000 gallons per day (gpd). Milton's water supply is from two sand wells (see Section 5.3.1); the treatment plant capacity for this city is 360,000 gpd.

Septic tanks are used in both cities.

Garbage Collection

Garbage collection in the county is by private contractor; however, both cities have municipal services. Landfill is used by both the county and cities as the method of disposal.

Schools

The public school system in the county includes both elementary and high school grades. There are no vocational training schools or colleges in the county. The nearest vocational school is in Carrollton, and the closest college is Hanover College in Hanover, Indiana.

The following are statistics on the county school system (Commonwealth of Kentucky, 1974b):

	Trimble County
Total Enrollment (Fall 1973)	1,270
Elementary	560
Middle School	350
High School	360
Student-Teacher Ratio	
Elementary	20:1
Middle School	27:1
High School	17:1
Percent High School Graduates to College	15.9
Expenditures per Pupil (1971-72)	$525
Bonded Indebtedness (June 30, 1972)	$1,249,000

Arrangements can be made through the vocational schools to provide training in specific skills required by an industrial plant. Instruction may be conducted in a vocational school or in the plant, depending upon the desired arrangement and availability of special equipment.

Hospitals

Hospital services are available in Carrollton, approximately 13 miles from Bedford, where a fully staffed and equipped 80-bed hospital is located. The Trimble County Health Department, located in Bedford, has a nurse on duty.

Other Services

South Central Bell supplies telephone service to both Bedford and Milton, but telegraph service is available only by phone to Carrollton.

Both cities have U.S. Post Offices where mail is received and dispatched once daily.

Neither city has a radio or television station. Both rely on transmissions from nearby cities such as Louisville, Cincinnati, or Indianapolis.

The Trimble Banner Democrat newspaper is published in Bedford and has a weekly circulation of 1,980.

A public library, The Trimble County Library, was opened in 1974 in Bedford.

Both Bedford and Milton have banks: the Bedford Loan and Deposit Bank in Bedford and the Farmers Bank of Milton in Milton.

Economic Summary

The economic composition of Trimble County and five surrounding counties is summarized in Table 5.5.1-2. The counties included in this table are those to which Trimble County residents commute in major numbers (Commonwealth of Kentucky, 1973a).

5.5.2 Trimble County Future Economy

Per Capita Income

The non-SMSA portion of the Louisville-Salt Subarea had a per capita income of $2,472 in 1970, which is projected to increase to $10,900 by 2020 (U.S. Water Resources Council, 1974). This compares to a per capita income of $3,573 in the Louisville SMSA in 1970 and $13,500 in 2020. For the total (both SMSA and non-SMSA portions) of the Louisville-Salt Subarea, the per capita income is projected to increase from $2,323 in 1970 to $13,000 in 2020. For the state, per capita income in 1970 was $2,752; it is projected at $11,900 for 2020. The U.S. had a per capita income of $3,476 in 1970, which is projected to increase to $13,200 by 2020. (All figures are in 1975 dollars.)

Employment

Employment in the non-SMSA portion of the Louisville-Salt Subarea is projected to increase by 73 percent from 1970 to 2020. Since population is projected to increase only 45 percent during this time, employment will outstrip total population growth. Employment in Louisville is projected to increase 116 percent from 1970 to 2020, a rate that is almost 30 percent greater than the population increase over the same time period. Employment for the total Louisville-Salt Subarea is projected to increase by 103 percent from 1970 to 2020.

State employment and population are projected to increase at the same rate as the non-SMSA portion of the subarea. However, employment growth in the subarea is projected to be greater than employment growth in the U.S., which is projected at 64 percent between 1970 and 2020.

TABLE 5.5.1-2

ECONOMIC SUMMARY OF TRIMBLE COUNTY GENERATING PLANT SITE REGION, KENTUCKY, AND INDIANA

	Trimble	Carroll	Henry	Jeff. Kent.	Jeff. Ind.	Oldham	Kentucky	Indiana
Commuters (from Trimble)	753	103	50	99	502	66	-	-
Median Family Income-1969	$ 6,596	6,885	6,791	9,813	8,556	8,444	7,439	9,966
Per Capita Monies Income - 1969	$ 2,073	2,311	2,399	3,162	2,570	2,415	2,425	3,070
Unemployment Rate - 1970	2.0%	8.1%	2.6%	3.9%	3.4%	3.7%	4.6%	4.1%
Labor Force	1,864	3,244	4,200	281,071	10,253	5,009	1,181,562	2,113,282
Employed	1,826	2,987	4,086	268,635	9,902	4,824	1,088,758	2,016,365
Taxes-1967	$178,800	472,500	542,400	84,147,500	3,224,800	101,200	208,680,000	695,996,000
Outstanding Debt-1970	$300,000	2,100,000	1,500,000	243,300,000	6,000,000	3,200,000	820,000,000	1,034,900,000
Total Houses	1,789	2,957	3,927	226,440	8,553	4,136	1,060,689	1,711,896
Older Than 1950	63.7%	66.2%	68.7%	48.8%	56.6%	48.5%	55.7%	59.4%
Owner Occupied	72.6%	62.0%	66.7%	65.0%	74.9%	69.1%	66.9%	71.1%
Median Value	$ 12,021	11,339	11,282	15,380	13,015	14,712	12,830	13,905
Lacking Plumbing	30.4%	26.8%	23.7%	2.8%	8.9%	13.6%	18.4%	5.1%

Source: U.S. Department of Commerce, 1970, 1973

Earnings by Major Category

There are nine major earnings groups--agriculture, forest, and fisheries; mining; contract construction; manufacturing; transportation, communication, and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government (U.S. Water Resources Council, 1974).

Non-SMSA Portion of the Louisville-Salt Subarea

Manufacturing was the largest earning category for the non-SMSA portion of the subarea in 1970 and is projected to be the largest again in 2020. Although manufacturing will increase by 505 percent from 1970 to 2020, finance, insurance, and real estate is the largest growth category, with an increase of 969 percent over the 50 years. This group was the fourth largest earnings category in 1970 and third in 2020. Growth rates for all earnings categories are listed in Table 5.5.2-1.

Louisville SMSA

Within the Louisville SMSA, manufacturing registered the largest volume of earnings in both 1970 and 2020. The growth rate of 478 percent, however, was not the largest recorded. Services are projected to grow at a rate of 1,028 percent, making it the fastest growing group. Services jumped from the third to the second largest earnings category from 1970 to 2020.

Louisville-Salt Subarea 511

Manufacturing within the Louisville-Salt Subarea was the largest category in 1970 and is projected to be the largest in 2020. Over the 50-year time period, manufacturing is projected to increase by 346 percent. However, services should have the largest rate of growth (891 percent).

Kentucky

For the state, manufacturing was the largest earnings group for both 1970 and 2020. The rate of growth from 1970 to 2020 is 626 percent. Services recorded a rate of growth of 917 percent, moving from fourth to second over the 50-year time period.

TABLE 5.5.2-1

GROWTH IN EARNINGS - 1970 TO 2020

	NON-SMSA PORTION OF SUBAREA			LOUISVILLE SMSA			SUBAREA			KENTUCKY			UNITED STATES		
	Rank*			Rank*			Rank*			Rank*			Rank*		
	1970	2020	Growth %	1970	2020	Growth %	1970	2020	Growth %	1970	2020	Growth %	1970	2020	Growth %
Agriculture, Forestry and Fishing	5	8	50	8	9	75	8	8	70	7	8	83	8	8	68
Mining	9	9	269	9	8	195	9	9	198	8	9	186	9	9	97
Construction	6	6	462	6	7	466	6	7	432	6	5	467	6	7	382
Manufacturing	1	1	505	1	1	478	1	1	346	1	1	626	1	1	312
Transportation Communication and Public Utilities	7	5	566	5	6	429	5	6	433	5	6	404	5	6	402
Wholesale and Retail Trade	3	4	377	2	3	432	2	4	361	3	4	414	3	4	340
Finance, Insurance and Real Estate	8	7	969	7	5	760	7	5	604	9	7	794	7	5	608
Services	4	3	913	3	2	1,028	4	2	891	4	2	917	4	2	764
Government	2	2	672	4	4	636	3	3	607	2	3	514	2	3	504

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*Based on the absolute value of earnings.

Source: U.S. Water Resources Council, 1974

National

At the national level, manufacturing was the largest contributor to total earnings but is projected to increase only 312 percent from 1970 to 2020, far below the largest gainer, services (767 percent).

5.5.3 Clark County Economy

Table 5.5.3-1 presents an economic summary of Clark County, Indiana, which lies within the Louisville SMSA. The following paragraphs present a profile of Region 14 of Indiana (defined by the Indiana Employment Security Division), which is composed of Clark, Crawford, Floyd, Harrison, Orange, Scott, and Washington Counties in Indiana (source of information: State of Indiana, no date b).

Clark County comprises 35.6 percent of the population of Region 14, which was 213,344 in 1970 (4.1 percent of the state population). Four cities in Region 14 account for 37 percent of the population:

New Albany, Floyd County - 38,402

Jeffersonville, Clark County - 19,906

Clarksville, Clark County - 13,963

Charlestown, Clark County - 5,890

Nonfarm wage and salary employment for Region 14 was about 53,700 in 1972. Farm employment exceeded 3,200 in 1970. The manufacturing industry employs 38 percent of the total nonfarm and salary workers. Clark County employs over 47 percent of the manufacturing workers in Region 14. Durable goods are the main manufacturing products in the region. The following is a breakdown by industry of the distribution of manufacturing employment in Region 14:

Lumber - 10%

Foods - 12%

Furniture - 17%

Ordnance - 21%

All Other - 40%

Ordnance is the largest manufacturing industry (more than 1 out of every 5 employees). The chief products of Region 14 are: ammunition, poultry products, canned tomatoes, refrigerated uncooked bakery goods, men's suits and topcoats, furniture, soap products, rubber footwear, gaskets, powdered metal products, metal containers, boats, and musical instruments.

TABLE 5.5.3-1
ECONOMIC SUMMARY OF CLARK COUNTY, INDIANA

	1970	1975	1980	1985	1990	2000
Median Family Income ($)	9,899	12,450	15,846	18,236	20,985	27,795
Per Capita Income ($)	2,996	3,527	4,489	5,166	5,945	7,874
Unemployment Rate (%)	3.05	5.17	*	*	*	*
Labor Force	19,619	36,002	56,520	62,578	*	82,392
Employed	18,920	34,141	54,259	60,075	*	79,097
Housing						
Total Number	24,088	28,148	33,334	38,563	44,788	59,044
Older than 1950	10,397	7,957	5,513	4,218	*	1,712
Owner-Occupied (%)	70.11	71.0	71.89	71.51	*	70.26
Median Value	$13,200[a]					
Lacking Plumbing	1,585					

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[a] Median value of new houses, 1976, was $27,000 (builder estimate: no appliances).

*Data not available.

Source: Kentuckiana Regional Planning and Development Agency, 1977

Retail and wholesale account for more than 20 percent of the Region 14 nonfarm wage and salary employment. This amounts to almost 11,000 persons working in 1,200 establishments. Of these persons, 73 percent have jobs in Clark and Floyd Counties.

Service jobs in Region 14 employ over 6,100 persons in 600 establishments, among which is Clark County Memorial Hospital.

The employment picture of Region 14 is stable. Table 5.5.3-2 presents past, present, and projected nonfarm wage and salary employment data for Clark County.

TABLE 5.5.3-2

NONFARM WAGE AND SALARY EMPLOYMENT
CLARK COUNTY, INDIANA
1971-1995

	1971	1975	1980	1985	1990	1995
Mining	90	106	119	130	142	155
Construction	703	893	1,013	1,185	1,398	1,629
Manufacturing	9,546	11,638	13,047	14,796	16,452	18,320
Transportation, Communications, and Utilities	1,225	1,386	1,559	1,762	2,015	2,263
Trade	4,404	5,359	6,308	7,420	8,809	10,347
Finance, Insurance and Utilities	520	623	734	864	1,024	1,202
Services	1,806	2,229	2,738	3,361	4,166	5,907
Government	2,701	3,313	4,067	4,896	5,940	7,109
TOTAL	20,995	25,547	29,585	34,414	39,946	46,122

Source: Schimpeler-Corradino Associates, 1974

5.6 LAND USE

The discussions of project area land use have been divided into two categories: Trimble County, Kentucky and Clark County, Indiana. The focus of the section is on Trimble County, as the transmission line corridor in Clark County is very preliminary. Further, the impact on land use of the actual transmission line route will be confined to a small linear area of the county.

5.6.1 Existing Land Use - Trimble County

Rural, Agricultural, and Woodland Land Uses

The site in Trimble County is principally rural and agricultural in nature, encompassing 2,440 acres. The land lies between the Ohio River on the west and an escarpment on the east and includes the Ohio River flood plain. Though the lower lying sections of the site are subject to occasional flooding, most of the area has been cleared, and a high percentage is used for crop production. The leading crops are: corn, tobacco, red clover, and lespedezas (Adams, 1975).

Directly inland from the river on the site, there is a rather steep escarpment which is primarily forest, woodland, and pastureland. A small percentage of this area is used for the cultivation of corn, tobacco, and grain (Adams, 1975).

Extending north and south along Highways 42 and 421 in the central part of Trimble County is a large area in which the majority of the agriculture is concentrated. Much of this land has been cleared and is currently being used for the cultivation of tobacco, small grain, apples, peaches, and strawberries (Adams, 1975).

The land situated east of Bedford has a steep, irregular topography and adverse soil conditions for extensive agriculture. Because of this, the majority of the area is wooded, although tobacco, corn, hay, and small grain are grown in some sections.

Land use patterns within Trimble County and its contiguous counties are dominated by farmland, as indicated in Table 5.6.1-1. Agricultural land use within Trimble County and surrounding counties from 1960 to 1970 showed a general decline. Farm population dropped 23 percent. The number of farms and the total acreage in farms within the county dropped 5 and 9 percent, respectively, from 1964 to 1969 (U.S. Department of Commerce, 1972). Production of burley tobacco was down 235 tons from 1971 to 1972 in Trimble County. Production, however, steadily increased. From 1969 to 1972 the acres of corn harvested in Trimble County increased from 2,900 to 3,200 acres (U.S. Department of Agriculture, 1973). Acres in soybeans and wheat increased from 1,300 to 2,300 and 900 to 1,400, respectively.

Included in the area surrounding the Trimble County plant site are the southeastern corner of Jefferson County and eastern Clark County, both in Indiana. Along the Ohio River, which constitutes the eastern border of both counties, are steep escarpments ascending from the river. These escarpments continue along the river and its larger tributaries.

TABLE 5.6.1-1

AGRICULTURAL DATA FOR TRIMBLE AND CONTIGUOUS COUNTIES, 1969

	Trimble	Carroll	Henry	Oldham
Number of Farms	616	485	1,247	520
Average Farm Size (acres)	124	134	138	206
Average Value per Farm	$31,509	$ 33,806	$41,738	$109,848
Market Value of Agricultural Produce Sold	$3,962,074	$3,053,886	$11,135,776	$ 7,180,745
Total Acres	93,440	83,200	184,960	117,760
Acres in Farms	76,691	64,931	171,963	107,356
Cropland (acres)	34,332	33,423	117,566	59,351
Harvest Cropland (acres)	12,576	9,348	28,228	24,261
Woodland (acres)	26,007	17,907	24,973	20,667
Cattle	9,321	9,471	34,008	24,637
Hogs	4,309	1,335	11,334	7,730
Sheep	333	238	3,465	778
Chickens	5,034	2,336	8,441	7,010
Burley Tobacco (tons, 1972)	3,611	2,050	5,000	843
Corn (acres)	2,900	2,000	7,900	6,900
Soy Beans (acres)	1,300	200	200	500
Wheat (acres)	900	200	400	1,100
Barley (acres)	*	*	100	*

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*Only a small amount.

Source: U.S. Department of Commerce, 1972

There are approximately 40 acres of apple and peach orchards 3.5 miles northwest of the Trimble County plant site in Indiana, just west of the wooded escarpment area (Howell, 1975). The steep escarpment continues south along the river into Clark County, located just west of Jefferson County. The escarpment area is unsuitable for agriculture and approximately 80 percent of it is wooded (Donaldson, 1975).

Inland from the river is the agricultural section of Clark and Jefferson Counties. The leading crops are corn, soybeans, small grains, and some truck crops. Pastureland and hayland are distributed throughout the counties. There is some timber production within the area; however, the operations are small and dispersed.

Residential Land Uses

The major residential zones within the area are Bedford and Milton in Trimble County, Kentucky; Madison, Hanover, Chelsea, and Paynesville in Jefferson County, Indiana; and New Washington in Clark County, Indiana. These are the concentrated areas of population; however, farms are scattered throughout all the counties.

Industry

Industries near the proposed site include timber production and a plastics products firm. Bedford Products, Incorporated, in Bedford, Trimble County, produces plastic injection molding and employs 18 people (Commonwealth of Kentucky, 1974a). Other industries are found in Madison to the north and Louisville to the southwest.

Mining

Mineral resources found in the area are principally limestone, clay, sand, and gravel. Sand and gravel are the major resources; these are found in a narrow band along the Ohio River. Presently, four commercial companies dredge material just off the proposed Trimble County plant site: Greene Enterprises, Martin Marietta, Nugent Sand Company, and E. T. Slider. There is no limit on the amount of sand or gravel that may be dredged (U.S. Army, 1975a).

Inland from the river, particularly in Trimble and Oldham Counties, are deposits of limestone and clay (Commonwealth of Kentucky, 1974a).

Though not in the immediate area, Oldham County has three crushed stone quarries; one directly west of LaGrange, one in the extreme southern fringe of the county, and the last one northwest of LaGrange. Oldham County also has deposits of dolomite in the central part of the county (Commonwealth of Kentucky, 1974b).

Two sand and gravel processing industries are found in the northwestern corner of Carroll County, bordering Trimble County on the east (Commonwealth of Kentucky, 1974b).

Existing Ohio River Power Plants

There are several power plants located on the Ohio River between Cincinnati and the Louisville area. These are identified in Table 2.6.1-1.

Recreational Land Uses

All of the counties surrounding the proposed site use the Ohio River for some kind of recreation (U.S. Department of Agriculture, 1971). The town of Milton has a boat ramp, which is the only access to the river for Trimble County. Madison, Indiana has several public and private boat docks along the river. The Annual Madison Regatta, a speedboat competition, is widely acclaimed and draws as many as 100,000 people to the area.

Bedford and Milton, Kentucky and Madison and New Washington, Indiana all provide public recreation areas such as parks, playgrounds, golf courses, tennis courts, baseball diamonds, and football fields. In addition, Bedford offers steeplechase horse racing and motorcycle races, and Milton offers auto racing.

Oldham County is planning to enhance its recreational facilities by a proposed recreation area to be located north of La Grange and Interstate Highway 71 in the east-central portion of the county.

The Clifty Falls State Park in Indiana is near Madison and offers a variety of recreational services including camping, picnicking, hiking, and riding trails (Public Service Indiana, 1972). Jefferson and Clark Counties have numerous caves and waterfalls extending south along the Ohio River.

Other recreational facilities can be found in Louisville, 41 miles to the southwest. Hunting is available at the Jefferson Proving Grounds, northwest of Madison, Indiana (U.S. Department of Agriculture, 1972).

Archaeology and Historical Sites

An archaeological and historical survey of the proposed Trimble County Generating Plant site was conducted in 1975 and 1976. The 1975 portion of the survey, which took place in April and June, was conducted by Dr. Donald Janzen (Associate Professor of Anthropology, Centre College of Kentucky), and Frederick Wilson (Kentucky Heritage Commission). The 1976 portions of the survey were conducted by Dr. Janzen from August to September and in November. The survey was conducted during different time periods in part because additional land for the site was acquired or planned for acquisition after the initial survey, and in part because, after the initial survey was completed, evidence was discovered by personnel from the University of Louisville

Archaeological Survey that suggested the possibility of significant archaeological sites being located on the previously surveyed property. The November survey was required because portions of the site were obscured by groundcover during the 1976 summer survey. A brief summary of each survey and its findings is presented below. The reports for each survey are on file with the Environmental Protection Agency, Region IV.

1. April to June, 1975 Survey - The 1975 survey resulted in the identification of 10 sites within the boundaries of the proposed project. Nine of these sites are classified as prehistoric and only one is classified as historic. According to Wilson and Janzen, none of the archaeological sites qualify as major areas of prehistoric activity. Most of the cultural material (e.g., projectile points, chippage) found at the sites indicated that the temporal range of prehistoric habitation was from Archaic to Middle Woodland times. All of the prehistoric sites characteristically displayed a low density and spatial concentration of cultural materials.

   The historic site contained a concentration of ceramic, glass, and metal artifacts. The precise date that the site was occupied is uncertain, but some of the artifacts indicate occupation occurred in the latter part of the 19th century. Evidence also suggests that the site was probably a residence and that it was probably destroyed by fire. The site does not warrant development as a cultural or recreational resource.

2. August to September, 1976 Survey - This survey included an investigation of land (the "Hall Tract" and Ravines RA and RB) acquired or planned for acquisition by the Applicant after the initial survey was conducted, as well as a reinvestigation of some areas previously surveyed in 1975. The August to September survey included trenching in addition to ground reconnaissance. In all, six trenches were excavated to depths ranging from 6.5 to 12 feet.

   The survey indicated that, with the exception of an area near the confluence of Corn Creek and the Ohio River, the Hall Tract has little archaeological potential. Immediately downstream from this confluence, a relatively high concentration of cultural materials indicated that an archaeological site was probably present on the alluvial plain. However, during the November, 1976 survey (discussed below), four trenches were excavated in this area, and no sites were unearthed. None of the farm buildings on the Hall Tract is of historical significance, and none will be nominated for inclusion in the National Register.

   The areas of the 1975 survey reinvestigated during 1976 did not produce any significant archaeological findings.

The highwall on the property, which was thought to contain significant cultural materials, was found to consist of reworked alluvial deposits. The value of any materials found in the reworked sediments is far less than materials from in situ deposits. Those areas adjacent to Corn Creek, its tributaries, and the oxbow were also found to have a low archaeological potential.

3. November 13, 1976 Survey - The November survey was conducted to reexamine the flood plain above the highwall near Corn Creek. During the previous investigations, the thick groundcover had prevented a walking survey of the area. The November survey included trenching as well as ground reconnaissance. No significant cultural materials indicating the presence of a prehistoric or historic site were recovered.

Two small cemeteries are located within the site boundaries. One cemetery, containing two graves with headstones, is located at the southern end of the site between County Road 1488 and the Ohio River. The other cemetery contains 8 or 9 graves, 6 of which have headstones. This cemetery, located at the northern end of the site, lies in the middle of the proposed ash pond location and will have to be moved to the cemetery at the south end of the site. The local undertaker has agreed to relocate the graves.

An historical and archaeological survey being conducted by the Commonwealth of Kentucky identifies three historic sites in proximity to the site that have potential for inclusion in the National Register. They are located approximately 10 miles from the plant site (Melton, 1975):

1. Milton Jail
2. Rogers House or Old Preston Mansion, near Milton
3. Pierce Brothers House, Old Bedford-Sulfur Road, Milton

Section 2.8 contains a list of all National Register sites in Trimble County.

5.6.2 Future Land Use - Trimble County

According to projected population trends within the Trimble County area, the city of Bedford will increase in size slowly. The majority of growth around Madison is occurring primarily to the north of the city. Increased residential land use in Bedford and Milton will be minor.

The generally remote location of the site, the current lack of industry, the sparse population, and the projected slow growth of the county all indicate very little potential change in the county's present agricultural nature. A summary of agricultural trends is presented in Table 5.6.2-1.

TABLE 5.6.2-1

AGRICULTURAL TRENDS

County	1970 Farm Population	1960-70 % Change	1969 Farms	1964-69 % Change	Acreage	1964-69 % Change
Carroll (Ky.)	1,354	-45.5	485	-2.2	65,000	-14.4
Clark (Ind.)	4,246	-13.8	1,043	-5.8	149,000	2.9
Henry (Ky.)	4,228	-20.4	1,247	-2.7	172,000	0.7
Jefferson (Ky.)	2,043	-51.6	994	14.5	88,000	-6.9
Jefferson (Ind.)	4,398	-14.1	1,316	2.3	160,000	-0.3
Oldham (Ky.)	1,950	-24.2	520	5.7	107,000	-1.4
Trimble (Ky.)	2,109	-23.1	616	-4.8	77,000	-9.2
Kentucky	381,696	-30.3	125,069	-6.0	15,968,000	-1.8
Indiana	370,590	-22.8	101,479	-6.1	17,573,000	-2.0

Source: U.S. Department of Commerce, 1973

The barge traffic on the river has shown a continual increase in tonnage moved through this section of the river (U.S. Army, 1968) (see Section 5.7). However, since there are no commercial docks on Trimble County's border, and no plans for future commercial docks, no environmental change is anticipated outside of the proposed generating plant.

Within the immediate vicinity of the proposed Trimble County Generating Plant, Public Service Indiana is proposing a nuclear generating plant. The plant will be located on Marble Hill in Indiana. The proposed location is approximately 2 miles upstream from the proposed Trimble County Generating Plant. Other proposed plants and their locations are indicated in Table 2.6.1-1.

5.6.3 Existing Land Use - Clark County, Indiana

Introduction

The preliminary transmission line corridor is located in a rural, agricultural, and sparsely populated area of Clark County, Indiana. The corridor is 9.3 miles long, 1 mile wide, and occupies approximately 6,213 acres. It extends in a westerly direction from the Ohio River to a proposed tie-in point approximately 2.6 miles west of New Washington, Indiana. Topographic relief varies from approximately 440 feet on the east along the Ohio River to 740 feet along the remainder of the corridor. The highest elevation within the study area is approximately 820 feet, along the eastern bluffs that border the Ohio River. The majority of the site area has been cleared for crop production. The primary crops are corn, soybeans, and wheat (Nickell, 1974).

The "bluff" area bordering the Ohio River within the eastern portion of the study area consists primarily of wooded land. Due to the steepness and general inaccessibility of this wooded land, it is unsuitable for cultivation. However, this area provides a significant habitat for wildlife.

A land use map of the preliminary transmission line corridor is presented in Section 5.2.4 on Figure 5.2.4-4.

Rural, Agricultural, and Woodland Land Uses

Land use patterns in Clark County are dominated by farming, as indicated in Table 5.6.3-1. Agricultural land use within the county is defined in Table 5.6.3-2. It has shown a small increase of 2.9 percent from 1964 to 1969 (U.S. Department of Commerce, 1973). In the same period, there was a 5.8 percent decline in total number of farms (U.S. Department of Commerce, 1973).

TABLE 5.6.3-1

CLARK COUNTY LAND USE PATTERNS
TRIMBLE COUNTY GENERATING PLANT

Linear Line Length

Land Use	Feet	Percent of Right-of-Way
Water (streams)	250	0.5
Ohio River	2,125	4.1
Forest and woodlands	9,250	18.0
Pasture, cropland, and idle land	39,250	76.4
Utility corridors	500	1.0
TOTAL	51,375	100.0

Transmission Corridor Acreages (150-foot right-of-way)

Land Use	Acreage	Percent of Total
Water (streams)	1.6	1.0
Ohio River	9.7	5.0
Forest and woodlands	38.1	22.0
Pasture, cropland, and idle land	126.0	71.0
Utility corridors	1.0	0.7
Residential	0.5	0.3
TOTAL	176.9	100.0

Study Area Land Use (1-mile-wide Corridor)

Land Use	Acreage	Percent of Total
Water (streams)	28.77	0.4
Ohio River	262.63	4.1
Forest and woodlands	1,424.17	22.0
Pasture, cropland, and idle land	4,542.38	70.1
Utility corridors	40.89	0.6
Residential	101.24	1.6
Institutional	6.77	0.1
Roads	69.22	1.1
TOTAL	6,476.07	100.0

TABLE 5.6.3-2

CLARK COUNTY, INDIANA AGRICULTURAL STATISTICS, 1969
TRIMBLE COUNTY GENERATING PLANT

Category	Value
Number of farms	1,043
Average farm size	143 acres
Average value per farm	$ 48,000
Market value of agricultural produce sold	$6,941,000
Total acreage	245,760
Acres in farms	149,000
Cropland acres	82,528
Harvest cropland acres	52,901
Woodland (acres)	25,528
Cattle	13,091
Hogs	5,859
Sheep	858
Horses	207
Chickens	2,055
Tobacco	507
Corn (acres)	12,135
Soybeans (acres)	14,023
Wheat (acres)	3,774

Source: Indiana Crop and Livestock Reporting Service, 1970

Percent Change, Clark County Farm Population
1960-1970

1970 Farm Population	1960-70 Percent Change	1969 Farms	1964-69 Percent Change	Acreage	1964-69 Percent Change
4,246	-13.8	1043	-5.8	149,000	2.9

Source: U.S. Department of Commerce, 1973

The northeastern portion of Clark County, including the study area, is well suited to grain raising and hog farming. Other parts of the area are better suited to general farming due to the soil characteristics (Nickell, 1974). Some farmers of the area derive a significant portion of their income from small acreages of tobacco. Meadow crops provide pasture for livestock, while vegetable crops are grown commercially in many small areas. These crops include cucumbers, sweet corn, strawberries, cantaloupe and muskmelons, tomatoes, and snap beans.

Due west of the Ohio River within the transmission corridor, the leading crops are corn, soybeans, and wheat, with pastureland and grazed cropland also present.

Timber production on woodlots within the corridor is primarily non-commercial, with woodlots being small and well disposed.

Residential Land Uses

The major residential concentrations within the study area are New Washington and Miles Point, Indiana. These consist of small unincorporated towns having population concentrations surrounded by rural land. The population of New Washington is approximately 500.

Industry

There is very little industrial development within the study area. General industrial characteristics of Clark County are discussed in Section 5.5.3.

Mining

Mineral resources found in Clark County, Indiana include limestone, dolomite, sand, and gravel. Sand and gravel deposits are found along the Ohio River. To the west are limestone and dolomite deposits. There are five industries involved in extraction of these deposits within Clark County. None is within the study area (Nickell, 1974).

Recreational Land Uses

New Washington provides public recreation areas, including parks, playgrounds, baseball diamonds, and football fields. Clark State Forest, located in northwestern Clark County approximately 12 miles southwest of New Washington, provides picnic facilities and "natural" recreation areas. A roadside picnic area is found north of New Washington on State Route 62 on the west side of the road.

History and Archaeology

An initial survey of existing records of archaeological and historical sites in the vicinity of the corridor was conducted in 1976. Four archaeological sites of prehistoric age were determined to be in close proximity (1/4 to 1/2 mile) to the edge of the corridor. Mounds and earthwork materials of unknown cultural affiliations have been found at these locations. In order to preserve the integrity of these sites, the Indiana State Archaeologist's office requested that the actual site locations remain undisclosed. There is also a probability that sites exist along bottomlands, bluffs adjacent to the Ohio River, and streams within the corridor. An archaeological reconnaissance will be conducted prior to clearing activities once the specific route alignment is established.

5.6.4 Future Land Use - Clark County, Indiana

The population of Clark County is projected to increase at a moderate rate (U.S. Department of Commerce, 1973).

The location of the study area, coupled with the low population density and projected growth rate (see Section 5.4.2), indicates low potential for change in Clark County agricultural trends.

5.7 TRANSPORTATION

5.7.1 Land Transportation

The following discussions of the land transportation network in the project area are broken into two parts: a discussion of the network in the vicinity of the plant in Kentucky, and a discussion of the network in the vicinity of the preliminary transmission line corridor in Indiana.

Kentucky Highways

The majority of Trimble County (approximately 80 percent) is within 1 mile of a "blacktop" road. Although there are still unpaved roads, most are all-weather blacktop roads.

Two major highways connect Trimble County to other areas: Kentucky Highway 42 and U.S. Highway 421. These two highways travel north-south through the central area of Trimble County. Route 42 extends from Louisville to Carrollton; Route 421 originates in Frankfort, Kentucky, extends through Madison, Indiana, and continues northward to Versailles, Indiana. These highways cross in the town of Bedford. Interstate Highway 71 connects Louisville and Cincinnati and skirts east Trimble County; exit ramps at Carrollton and New Castle provide access to Bedford (Commonwealth of Kentucky, 1973a).

Kentucky Highway 42 also runs through the western section of Oldham County. Kentucky Highway 393 runs north-south through the central region of Oldham County, west of La Grange. The small number of roads in the area generally follow the agricultural section boundaries of the county. Very few roads traverse the wooded areas (Oldham County Planning and Zoning Commission, 1968).

Clark County Highways

The majority of the rural areas in Clark County are within 1-1/2 to 2 miles of a "blacktop" road. There are many unpaved rural roads, but a majority of the roads are all-weather asphalt roads.

Several state and federal highways pass through this county. Interstate 65 and U.S. Highway No. 31 cross the county in a north-south direction. State Routes 3 and 62 cross the county in a north-south direction, and State Routes 60 and 160 cross the western part of Clark County in an east-west direction. State Route 62 runs through New Washington, Indiana, which lies approximately 2.6 miles east of the proposed preliminary corridor terminus. It then continues north from Clark County, through Jefferson County to Madison, and then northward to Dillsboro, Indiana. A country road connects New Washington with Bethlehem, a small town on the Ohio River to the south.

Kentucky Railroads

The railroad nearest to the site is the Carrollton Railroad, a subsidiary of the Louisville and Nashville Railroad. This railroad is located in Carrollton, 13 miles northeast of Bedford. The actual rail line passes through the southeastern corner of Trimble County. The services available include three northbound and three southbound freights per week. Other railroad facilities available in the area are located at Louisville, Kentucky and Cincinnati, Ohio.

Clark County, Indiana Railroads

The Baltimore & Ohio and the Penn Central Railroads pass through Clark County in a north-south direction. The Monon Railroad passes through the western part of Clark County. Railway services are available in Madison, where the Penn Central Railroad provides a local freight service with a feeder line to Columbus, Indiana.

Passenger and freight services are available 22 miles north of Madison at North Vernon, Indiana by the B&O Railroad.

Kentucky and Clark County, Indiana Bus Lines

Bus transportation is available in the area by Greyhound Lines and White Star Lines. Greyhound services Clarksville, Charleston, Jeffersonville, New Albany, and Madison, Indiana and Milton, Bedford, and La Grange, Kentucky. White Star Lines has a direct route from Madison to Indianapolis. Both lines offer small freight and package service.

5.7.2 Air Transportation

Within the general site area, there are no airfields or airports. Madison, Indiana, 10 miles north of Bedford, has a landing strip at the Jefferson Proving Grounds, which is closed; this airport is 4 miles northwest of Madison. A second strip is the municipal airport located west of Madison; however, this is available only for small aircraft making visual landings. The airport provides only advisory landing information.

Within the transmission corridor study area, there are no airfields or airports. There is a small noncommercial airport north of Clarksville in Clark County, approximately 20 miles south of the preliminary corridor. The nearest airport is the municipal airport at Madison.

Commercial service by major air carriers is available at Standiford Field, located just south of Louisville, 41 miles south and west of the Louisville Gas and Electric Company site.

The proposed plant site and preliminary transmission corridor are not located within any prohibited, restricted, warning, or alert zones. The nearest such zone is approximately 5 miles north of Madison and extends northward to Nebraska and New Marion, Indiana. Two low altitude Federal Airways are located near the proposed site, one 58° out of Nabb, Indiana and the second 85° out of Nabb. The first connects to Cincinnati, the latter to Falmouth, Kentucky. The latter airway passes over the proposed site directly west of Bedford. The nearest controlled air space centers on the Madison Airport. Its southern limit extends to a point several miles north of the proposed site.

5.7.3 River Transportation

Tables 5.7.3-1 and 5.7.3-2 present information on barge traffic through the Cannelton and McAlpine Locks and Dams. Most of the information provided in these tables and in the following paragraphs was provided by the U.S. Army, Louisville District Corps of Engineers (1976).

In 1975, there were 5,417 commercial vessel lockages through the Cannelton locks and 4,927 commercial vessel lockages through the McAlpine locks (U.S. Army, 1976). From August to November 1975, 327 recreational vessels were locked through the Cannelton locks, while 933 recreational vessels were locked through the McAlpine locks. Totals for commercial vessels for 1976 (January through June) were: 2,644 at Cannelton Locks and Dam and 2,629 at McAlpine Locks and Dam. This compares with 2,666 commercial vessels at Cannelton Locks and Dam and 2,453 at McAlpine Locks and Dam during the same period in 1975. Recreational vessel lockages at Cannelton Locks and Dam in 1976, January through May, were 386; for McAlpine Locks and Dam, January through April and June, recreational vessel lockages were 891.

Since 1930, river traffic has grown considerably, as evidenced by the following:

1930	1,000,000 tons
1940	3,500,000 tons
1950	7,500,000 tons
1960	20,000,000 tons
1970	33,000,000 tons
1972	37,000,000 tons

In 1975, 10,761,100 tons moved through the Cannelton locks between August and October, and 15,641,000 tons moved through the McAlpine locks between August and December. In 1976, January through May, 17,428,200 tons moved through the Cannelton locks, while 15,326,200 tons moved through the McAlpine locks from January through June (May data not included).

The commodities constituting the greatest river freight traffic are petroleum fuels, crude petroleum, coal, coke, chemicals, chemical fertilizers, minerals, and ores (Table 5.7.3-3).

TABLE 5.7.3-1

BARGE TRAFFIC, AUGUST 1975 THROUGH JUNE 1976
CANNELTON AND MCALPINE LOCKS AND DAMS, OHIO RIVER

	Cannelton Locks and Dam			McAlpine Locks and Dam		
Date	Thousand Tons	Thousand Tons per Day	Number of Recreational Vessels	Thousand Tons	Thousand Tons per Day	Number of Recreational Vessels
1975						
August	3,470.8	112.0	161	3,069.2	99.0	400
September	3,675.6	122.5	99	3,213.8	107.1	194
October	3,614.7	116.6	38	3,221.0	103.9	206
November	*	*	29	3,232.3	107.7	101
December	*	*	*	2,904.7	93.7	32
1976						
January	3,224.3	104.0	4	2,979.9	96.1	25
February	3,304.3	113.9	23	3,074.4	106.0	31
March	3,813.4	123.0	18	3,469.4	111.9	117
April	3,404.7	113.5	169	2,838.6	94.6	261
May	3,681.5	118.8	172	*	*	*
June	*	*	*	2,963.9	98.6	457
TOTALS	28,189.3	1,848.6	713	33,805.6	1,018.6	1,824

Source: U.S. Army, 1976

TABLE 5.7.3-2

COMMERCIAL VESSEL LOCKAGES THROUGH THE CANNELTON AND THE MCALPINE LOCKS AND DAMS, OHIO RIVER, JANUARY 1975 THROUGH JUNE 1976

	Cannelton			McAlpine		
Date	Upriver	Downriver	Total	Upriver	Downriver	Total
1975						
January	230	229	459	183	199	382
February	205	207	412	198	207	405
March	211	208	419	206	193	399
April	200	211	411	200	206	406
May	243	241	484	228	227	455
June	239	242	481	190	216	406
July	215	213	428	202	196	398
August	219	232	451	185	221	406
September	239	225	464	216	200	416
October	241	241	482	207	208	415
November	251	247	498	208	214	422
December	213	215	428	213	204	417
Total	2,706	2,711	5,417	2,436	2,491	4,927
1976						
January	203	195	398	198	201	399
February	203	205	408	204	204	408
March	242	255	497	233	239	472
April	227	230	457	209	219	472
May	223	222	445	236	235	471
June	222	217	439	222	229	451
Total	1,320	1,324	2,644	1,302	1,427	2,629

TABLE 5.7.3-3

OHIO RIVER COMMODITY FLOW FOR THE TRIMBLE COUNTY AREA

	Upriver To Pittsburgh (Tons x 10^6)	Downriver From Pittsburgh (Tons x 10^6)
Petroleum Fuels	4.0	2.0
Crude Petroleum	6.0	0.0
Coal and Coke	9.0	1.0
Iron Ore, Iron and Steel	1.0	2.0
Ores and Minerals	2.5	0.5
Chemicals and Chemical Fertilizers	3.5	1.0
Grain	0.0	0.5
Aggregates	0.5	0.5
All Others	2.5	0.5
TOTAL	29.0	8.0

Source: Fluor Pioneer Inc., 1975

5.8 AESTHETIC QUALITIES

5.8.1 Plant Site, Ravines, and Kentucky Transmission Line Corridor

The proposed Trimble County Plant site and its surroundings have characteristics typical of the rural-agricultural bottomland areas along this portion of the Ohio River. These areas are characterized by flat expanses of cultivated land bordered by the river on one side and steep, wooded uplands on the other.

The most striking visual characteristic of the proposed Trimble County Generating Plant site to a person standing on the site is the broad expanse of flat bottomland bounded on all sides by hills and bluffs (see Figure 5.8.1-1). During much of the year, crops hide the river from the view of a person standing on the central portion of the site. Also, in the northern half of the site, unless one is standing on the river bank or cultivated land just along the bank, the view of the river is cut off by the bottomland woods along the oxbow.

The main approach to the site is along State Route 754; this road winds down from U.S. Route 42 through the upland areas and a natural break in the bluffs, at which point the bottomland, Wises Landing, the river, and the bluffs across the river are seen for the first time. From Route 754, the site stretches away to the right, and the community of Wises Landing is visible to the left. The site is not entirely visible from 754, however, as the terrain along the north side of the road is elevated above the roadbed. The fullest view of the site is obtained after one has turned onto County Road 1488 and traveled about 3/5's of a mile north along this road. This is the major vantage point for the site. The bluffs overlooking the site do not have public roads near enough to their edge for travellers to see the site through the heavy woods that cover most of the upland areas. A potential full view of the flat bottomland portion of the site from the narrow flood plain area on the Indiana side of the river (which begins approximately across from the mouth of Corn Creek) is blocked by the bottomland woods in the northern half of the site.

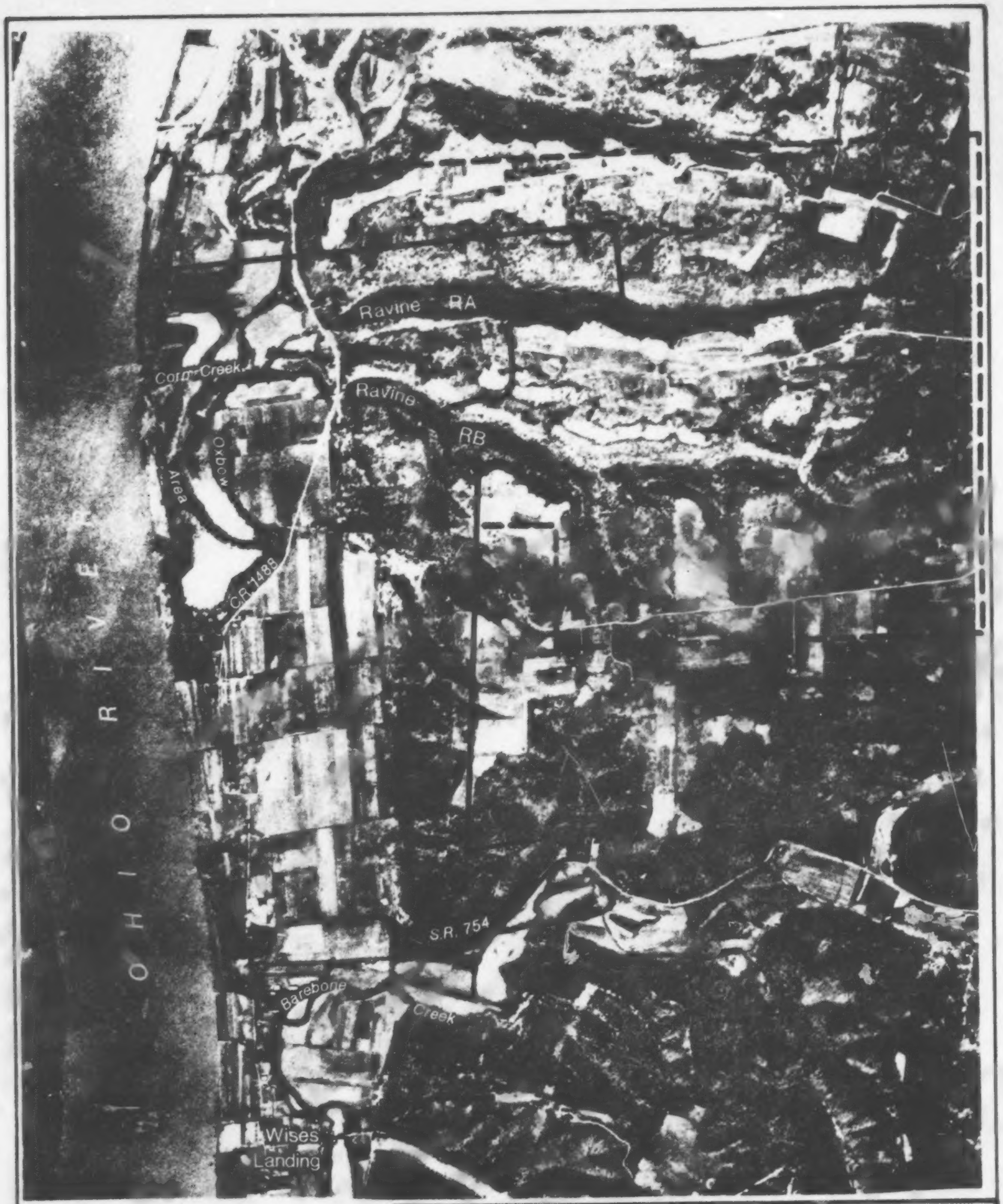
The view of the site from County Road 1488 during the growing season is dominated by the agricultural use of the site. The open areas of the bottomland are primarily devoted to the cultivation of corn and soybeans; cropland to the north of the site is also used for tobacco. The river and the Indiana bluffs are to the left of County Road 1488 as one travels north through the bottomland; to the right, about 2,500 feet from the road, is the upland portion of the site, which rises abruptly 150 to 350 feet above the bottomland. The bottomland woods vegetation of the oxbow and Corn Creek breaks up the otherwise large expanse of open area that the agricultural use of the bottomland has created.

Wises Landing to the south of the site is a very small, stable community that blends in with the rural-agricultural character of the bottomland.

In sum, the proposed plant site is entirely rural in nature and primarily consists of natural and man-modified natural elements that are visually distinct from each other. The distinct components of the setting provide a pleasing variety, with the steep, wooded bluffs and the straight, wide band of the river acting as a frame that sets off the flat, cultivated expanse of the bottomland portions of the site. The ribbon of bottomland woods on the site provides further visual diversity. The visual diversity, however, is not inharmonious; the visual components of the site and its environs blend to form a pleasant rural landscape that is unbroken even by the presence of Wises Landing.

5.8.2 Preliminary Transmission Line Corridor (Indiana)

The preliminary transmission line corridor trends west from the steep, wooded bluffs along the Ohio River through rolling agricultural land to its terminus point 2.6 miles west of New Washington, Indiana. Visually, the area is dominated by open expanses of cultivated fields broken by a few roads, fencerows, wood lots, and farmhouses. New Washington provides the only real visual contrast to the rural landscape.


OHIO RIVER
Ravine RA
Corn Creek
Ravine RB
Oxbow Area
CR 1488
S.R. 754
Barebone Creek
Wises Landing

LEGEND:

▬	PLANT SITE BOUNDARY
– – –	PROPOSED BOUNDARY EXTENTION

N

LOUISVILLE GAS & ELECTRIC CO.
TRIMBLE COUNTY GENERATING PLANT

PROPOSED PLANT SITE

FIGURE 5.8.1-1

5.9 SENSITIVE AREAS

Within the project area, including the Clark County, Indiana preliminary transmission line corridor, 10 sensitive areas have been identified: Corn Creek; the Corn Creek oxbow; the Mahoney property to the north of the proposed Trimble County Generating Plant boundary; historical sites in Bedford, Milton, and Hunter's Bottom, Kentucky; Madison, Indiana; and various areas in Clark County, Indiana near the preliminary transmission line corridor. By sensitive area we mean an area that has some unique quality that should be preserved or that plays an important role in the human or natural life of an area and that could be disturbed or destroyed by the proposed project.

5.9.1 Corn Creek and the Corn Creek Oxbow

As indicated in Section 5.2.4, Corn Creek and the oxbow area are heavily used by area wildlife. While the habitat they provide is not unique, in the sense that similar habitat types can be found elsewhere along the river, the quality of this habitat makes the area worthy of special attention. The value of the habitat provided by the bottomland woods of the oxbow and Corn Creek is tied to the surrounding agricultural and upland areas. The variety of habitat provided by the combination of agricultural, bottomland wood, stream, and upland wood vegetation types attracts a large number of wildlife to the area. These species would not be able to find as varied or productive an area elsewhere within the project area.

5.9.2 The Mahoney Property

The Mahoney property to the north of the plant site is believed to contain a unique archaeological site. While this site has not been formally investigated, Wilson and Janzen (who conducted the archaeological investigation of the proposed plant site) inspected the site in 1975, and they called it "spectacular" (Wilson and Janzen, 1975). Personnel from the University of Louisville Archaeological Survey also discovered an *in situ* site in the highwall along the Mahoney property; they have classified this site as Early Archaic.

5.9.3 Bedford, Milton, and Hunter's Bottom, Kentucky

Bedford, Milton, and Hunter's Bottom, Kentucky all have sites listed in *The National Register of Historic Places* (see Sections 2.8 and 5.6.1).

5.9.4 Madison, Indiana

The downtown area of Madison, Indiana is also listed in *The National Register of Historic Places*. The Historical Society of Indiana is presently making a concerted effort to rehabilitate numerous structures constructed during the early and middle nineteenth century. These structures are typical of Ohio River architecture of the nineteenth century, many of which have already been destroyed in other cities that were contemporary with Madison during the nineteenth century.

Madison, Indiana is also a sensitive area from an air quality standpoint. There have been repeated violations of ambient air quality standards for sulfur dioxide and particulates in this area (see Section 5.1.2).

5.9.5 Clark County Preliminary Transmission Line Corridor

The State Archaeologist from Indiana has indicated several known and potentially important archaeological sites within and near the preliminary transmission line corridor. Areas of potential significance have been indicated on the map presented in Section 5.2.4, Figure 5.2.4-4. Known sites are on file with the Glenn A. Black Laboratory at the University of Indiana, and this information has been given to the Applicant.

Clark State Forest, northwest of the proposed terminus of the Indiana route, is an important plant and wildlife conservation area. The Indiana Arsenal, south of the preliminary corridor, also provides a woodland-wildlife refuge area.

5.10 RELATIONSHIP OF PROPOSED PROJECT TO OTHER LAND USE PROJECTS

5.10.1 Relationship to Federal Land Use Projects

There is currently no federal legislation specifically designed to control land use. However, some federal agencies do have responsibility for programs that help to preserve and develop land resources.

The following federal agencies were consulted to determine if any federal land use projects such as dams, national parks, or historic areas either exist or are being planned for the Trimble County plant site area. This area includes portions of Jefferson and Clark Counties in Indiana and Oldham and Trimble Counties in Kentucky.

Department of Agriculture

Department of the Army, Corps of Engineers

Department of Health, Education and Welfare

Department of Housing and Urban Development

Department of the Interior

Department of Transportation

Federal Power Commission

Department of Commerce

According to the above agencies, there are no federal land use projects existing or planned for the Trimble County plant site area. Therefore, no conflict between the proposed Trimble County Power Plant and any federal land use project is predicted.

5.10.2 Relationship to Regional Land Use Projects

The regional planning agency that covers Trimble County is the Kentuckiana Regional Planning and Development Agency (KIPDA). The Ohio-Kentucky-Indiana Regional Planning Authority (OKI) does planning in parts of each of the three states of Ohio, Kentucky, and Indiana but does not include Trimble County in its territory.

Trimble County is part of a nine-county regional land use plan prepared by the Kentuckiana Regional Planning and Development Agency. The nine counties in the project are: Clark and Floyd in Indiana and Trimble, Jefferson, Bullitt, Spencer, Shelby, Oldham, and Henry in Kentucky.

This plan "is based upon environmental factors and attempts to provide a regional approach to possible future growth" (Kentuckiana Regional Planning and Development Agency, 1975).

The Trimble County plant site is directly across the Ohio River from Jefferson and Clark Counties, Indiana. Jefferson County is one of eight Indiana counties sponsoring a plan known as the Historic Hoosier Hills Resource Conservation and Development Project. This project was developed by the sponsoring counties with assistance from several federal, state, and local governmental agencies; community organizations and institutions; and the Ohio-Kentucky-Indiana Regional Planning Authority. The major objective of this project is to "act as a catalyst in motivating local people to improve the overall economic and social problems of the area, and to properly develop, utilize and conserve the natural and human resources of the area. The goal is to make Historic Hoosier Hills a better place to live, work and play" (U.S. Department of Agriculture, 1972b).

5.10.3 Relationship to State Land Use Projects

The following state agencies were consulted to determine if any state land use projects either exist or are being planned in the Trimble County plant site area:

Department of Commerce, Kentucky

Department of Agriculture, Kentucky

Department of Fish & Wildlife Resources, Kentucky

Department of Natural Resources & Environmental Protection, Kentucky

Department of Parks, Kentucky

Department of Public Information, Kentucky

Department of Commerce, Indiana

Department of Natural Resources, Indiana

According to the above agencies, there are no state land use projects existing or planned for the Trimble County plant site area. Therefore, no conflict between the proposed Trimble County Generating Plant and any state land use project is predicted.

5.10.4 Relationship to Local Land Use Projects

Adjacent to the southern limits of the city of Bedford (which lies approximately 5-1/2 miles from the proposed Trimble County plant site), the Trimble County Chamber of Commerce has option on a 28-acre industrial site. Presently, there are no plans to develop this industrial site.

In 1971, the U.S. Soil Conservation Service and Cooperative Extension Service published a report entitled, "An Appraisal of Potential for Outdoor Recreation Development in Trimble County, Kentucky" (U.S. Department of Agriculture, 1971). This type of appraisal was done for all counties in the United States. This report is intended to aid groups and individuals by pointing out the potential for certain types of recreation and enterprises in various areas of the county. It is also intended to be a guide for evaluating the recreational possibilities of specific locations within the county. There are, however, no specific plans cited in the report.

It has been determined that no specific land use projects have been planned within the county; hence, no conflict between the proposed Trimble County power plant and any local land use project is predicted.